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PROGRAM PLANNING AND APPRAISAL METHODOLOGY

BOOZ, ALLEN APPLIED RESEARCH
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FEBRUARY 1977

FINAL REPORT FOR PERIOD
MAY 1976-JANUARY 1977

AIR FORCE ARMAMENT LABORATORY
AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE
EGLIN AIR FORCE BASE, FLORIDA

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This document provides a summary of the planning processes currently employed by the DoD, USAF, and AFATL, the interrelationships of these processes, and a description of the planning documents used at each level. A review of historical milestones in the development of the Planning, Programming, and Budgeting System from 1961 to 1973 is included as an Appendix. An appraisal methodology that instills rigor and enhances objectiveness in the planning process and that provides

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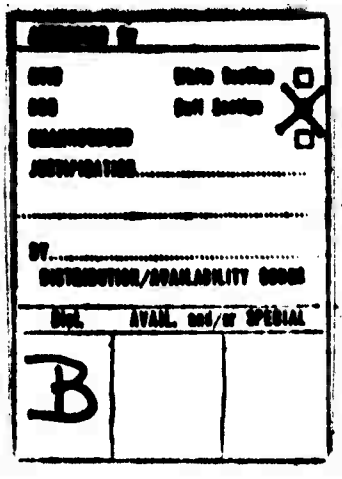
a documented corporate memory and audit trail is described. The use of the methodology is illustrated by an example of the appraisal process for selected Armament Laboratory programs.



PREFACE

This report documents work accomplished during the period 12 May 1976 through 15 January 1977 by Booz, Allen & Hamilton Inc., 362 Beal Parkway, N.W., Ft. Walton Beach, Florida, under Contract Number F08635-76-C-0226 with the Air Force Armament Laboratory, Eglin Air Force Base, Florida. The program monitor for the Armament Laboratory was Mr. James M. Kirkpatrick (DLA).

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

John H. Arnold
Director, Research and Plans

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SECTION I

INTRODUCTION

This report presents the results from the initial phase of an effort to develop an advanced planning and appraisal methodology. The methodology will subsequently be introduced and employed by the Air Force Armament Laboratory (AFATL) to evaluate and rank programs proposed for funding. The proposed methodology will assist in increasing the rigor and objectivity of the AFATL planning process. Inherent in the capabilities will be the development of a clearly defined audit trail and a well documented corporate memory.

The degree of success, or failure, of any activity can often be translated into the level of effort that had been applied to the planning process. The importance of sound, logical, and thorough planning cannot be overemphasized, particularly in the area of national security. The long lead times required for the development of weapon systems and the limited resources available for research and development of these weapon systems are constraints that continuously confront defense planning activities. The complex nature of the required weapon system and the versatility that is demanded for our capabilities in meeting the projected threats require not only that our resources be expended on programs that will counter the threat, but that they be expended in the most cost effective manner. The number of advocated programs far exceed the allocated resources and a judicious selection of programs must be made against the constraining factors.

In subsequent sections, this report presents a brief description of the Air Force Armament Laboratory and then proceeds with an overview of planning procedures currently in operation. A definition of the significant documents which provide the guidelines for these procedures is also included. Then follows a section which addresses the current procedures and then a new appraisal methodology is introduced as a proposed improvement to the current system. A detailed description of the appraisal methodology and examples of its application conclude the body of the document. The appendices include reference material pertinent to this report.

1. R&D APPRAISAL

There are major problems in the area of R&D Appraisal and they seem to be reflected in almost all planning processes. These problems are:

- Feasibility of implementing a methodology
- Objective definition of requirements and goals
- Maintaining objectivity
- Credibility of results
- Presentation and usefulness.

The feasibility of implementing a methodology entails the consideration of a number of factors which relate primarily to resource expenditures. The most influential factors to be judged are the cost, the time required, the drain imposed on technical manpower, and the staff required.

The objective definition of requirements and goals that a candidate program must satisfy is a critical issue. The depth to which this definition is accomplished is a controversial point. Inadequate definition fosters a hobby shop atmosphere while a too restrictive definition stifles innovation and suggests micro-management.

Maintaining objectivity becomes increasingly difficult the longer an appraisal methodology is used. The more familiar a program advocator is with the appraisal techniques the more likely he is to develop means for circumventing the system.

Establishing the credibility of the results from an appraisal effort becomes a severe problem in military R&D. The involvement of the Congress and the diversity of opinions among the concerned members contribute heavily to this problem. A creative and sincere presentation of appraisal results can alleviate this situation.

2. BACKGROUND

The ever increasing constraints imposed on the R&D funds necessitate that every effort be made to identify and pursue the development programs which offer the greatest potential to satisfy the most urgent needs. The current

process utilized by the Armament Laboratory is not ideally structured to ensure the objectivity required by this philosophy. Problems associated with the current planning process are:

- The process is highly subjective. Development decisions are frequently made on an emotional basis in lieu of selecting the best candidate to satisfy a specific need as determined through a meaningful analysis.

- Funding magnitudes as provided by "Higher Headquarters" provide the initial guidelines for the level of effort to be devoted to a functional area.

- The funding guidelines filter down to the individual decisions where a strawman program is developed to fall within the funding constraints.

- AFATL inputs have not always coincided with the time table of decision milestone events at Headquarters Air Force Systems Command (AFSC), Headquarters USAF, DDR&E, and the Congress. Untimely inputs quite often fail to achieve the warranted impact on a decision. While the ultimate goal of an appraisal methodology is to ensure stringency and objectivity in the planning process, it must also contain the capability to appraise ongoing programs for transition to advanced levels of development activity.

- Many of the AFATL programs receive independent management assistance from DDR&E and Headquarters USAF, as well as AFSC. This phenomenon, while not traditional to a military organization, does serve to provide broad exposure to the programs receiving special attention.

- Often, program decisions do not contain sufficient rigor to demonstrate their real applicability to operational needs, the ultimate objective of the program, the risk involved, their true desirability over alternative approaches and other factors influencing the advocacy/approval decision process.

A review of the problems confronting the AFATL planners shows the need for rigor, objectiveness, and documented rationale for its program decisions. A preliminary methodology that will enhance the objectiveness in the planning activities and provide a documented corporate memory and audit trail has been developed. A discussion of the methodology and examples of its use follow in the remaining sections of this report.

SECTION II

AIR FORCE ARMAMENT LABORATORY MISSION AND ORGANIZATION

This section provides a brief overview of the mission and organization of the Air Force Armament Laboratory.

1. MISSION

The Air Force Armament Laboratory is a unique organization within the Air Force Systems Command. It is an integral part of the Armament Development and Test Center (ADTC) but yet is accorded full Laboratory status and reacts to program guidance and direction for exploratory and advanced technology development from the AFSC Director of Science and Technology. Research direction is provided by the Air Force Office of Scientific Research (AFOSR).

The AFATL is responsible for providing the Air Force with the most effective and efficient nonnuclear air armament at the most economical cost achievable through existing or readily obtainable technology. Discharging of this responsibility requires that the AFATL:

- Develop and maintain a broad technology base in the scientific and engineering disciplines associated with the development of nonnuclear weapons and associated equipment.
- Provide program/project management for the AFSC exploratory and advanced development of guided and unguided nonnuclear weapons, including the related areas of munition suspension and release equipment, weapons terminal effects, and aerial targets.
- Serve as the AFSC lead Laboratory for Guided Weapons Development including both air-to-air and air-to-surface.
- Ensure the potential for rapid application of weapon research and technology to advanced armament systems.

- Provide technical support in air armament to other AFSC programs and operational support projects.

2. ORGANIZATION

The AFATL is organized into three product-oriented divisions which are responsible for all research and developmental activities devoted to conventional munitions. The range of efforts encompass research, exploratory, and advanced development and systems support. Additionally, two support divisions and two staff offices provide general support, analysis, planning, and environmental assessment. These divisions and their respective responsibilities are:

- The Munitions Division develops fuzes, bombs, fuel air munitions, mines, clusters and cluster bombs, submunitions, warheads, stores management subsystems, suspension and release equipment, and supporting ground handling equipment. Additionally, the division executes the Air Force Aircraft Compatibility Program.

- The Guided Weapons Division directs the development and feasibility demonstration of air-to-surface weapons systems, air-to-air missile systems, aerial target and component technologies to include system simulation, target detection and acquisition, guidance, control, and integration of these guided weapons systems.

- The Guns, Rockets, and Explosives Division develops and tests new guns, related ammunition, feed systems, gun pods, rockets, rocket launchers and associated equipment.

- The Analysis Division performs studies and analyses in weapon effectiveness, cost effectiveness, and exterior ballistics in support of the Laboratory munitions development programs.

- The Operations Division supports the entire Laboratory in the areas of program and fiscal reporting, security, administration, STINFO, graphics, technical applications, technical reports, and general logistics support.

- The Office of Research and Plans performs the long range planning function and associated tasks including technological forecasting, threat assessment and forecasting, mission analyses, etc. In addition, this office provides overall staff direction for the research programs.

- The Environics and Human Factors Office assures compliance with the AFR 19-1 and 19-2 by performing research and development to identify and assess the environmental impact of nonnuclear munitions research, development, and testing for the Laboratory.

SECTION III

CURRENT PLANNING PROCEDURES RELEVANT TO THE AIR FORCE ARMAMENT LABORATORY

This section is devoted to a brief description of the DoD, USAF, and AFATL Planning and Requirements Process and the related documents. These documents are described individually in the next section of this report. The planning documents provide general guidance which spans a broad spectrum of subjects or programs. Although used as justification documents for programs, they also provide general guidance in the form of objectives. The requirements documents are necessary in the authorization process to provide the justification for the funding of a specific program or a set of related programs.

DoD level planning is based upon the Planning, Programming and Budgeting System (PPBS). A discussion of the PPBS, how it relates to the military services and the scheduled program reviews is included in the first part of this section. The USAF and AFSC planning process follows and describes the procedures used for program planning and implementation. Finally, the AFATL planning process and its interface with AFSC is discussed.

1. DoD LEVEL PLANNING

The Department of Defense established a Planning, Programming, and Budgeting System in 1962 which provides the guidelines for the military services to formulate a 5-year development plan. The plans from all the services are combined into a Five Year Defense Program (FYDP) which provides the official program for the Armed Forces and presents the funding levels and other resources required to support them. The FYDP is updated by the programming/budgeting process on an annual basis. The overview of the DoD planning, programming, and budgeting process, as prepared for the 22 November 1976 meeting between the Secretary of Defense Rumsfeld and then President-elect Carter, and the 1961-1973 historical milestones are provided as Appendix A. The schematic of the Defense PPBS process (Figure 1) reflects the interactions and continuous flow of planning and programming data throughout the DoD. This close association throughout the planning and programming process is the likely explanation for the hands-on management philosophy

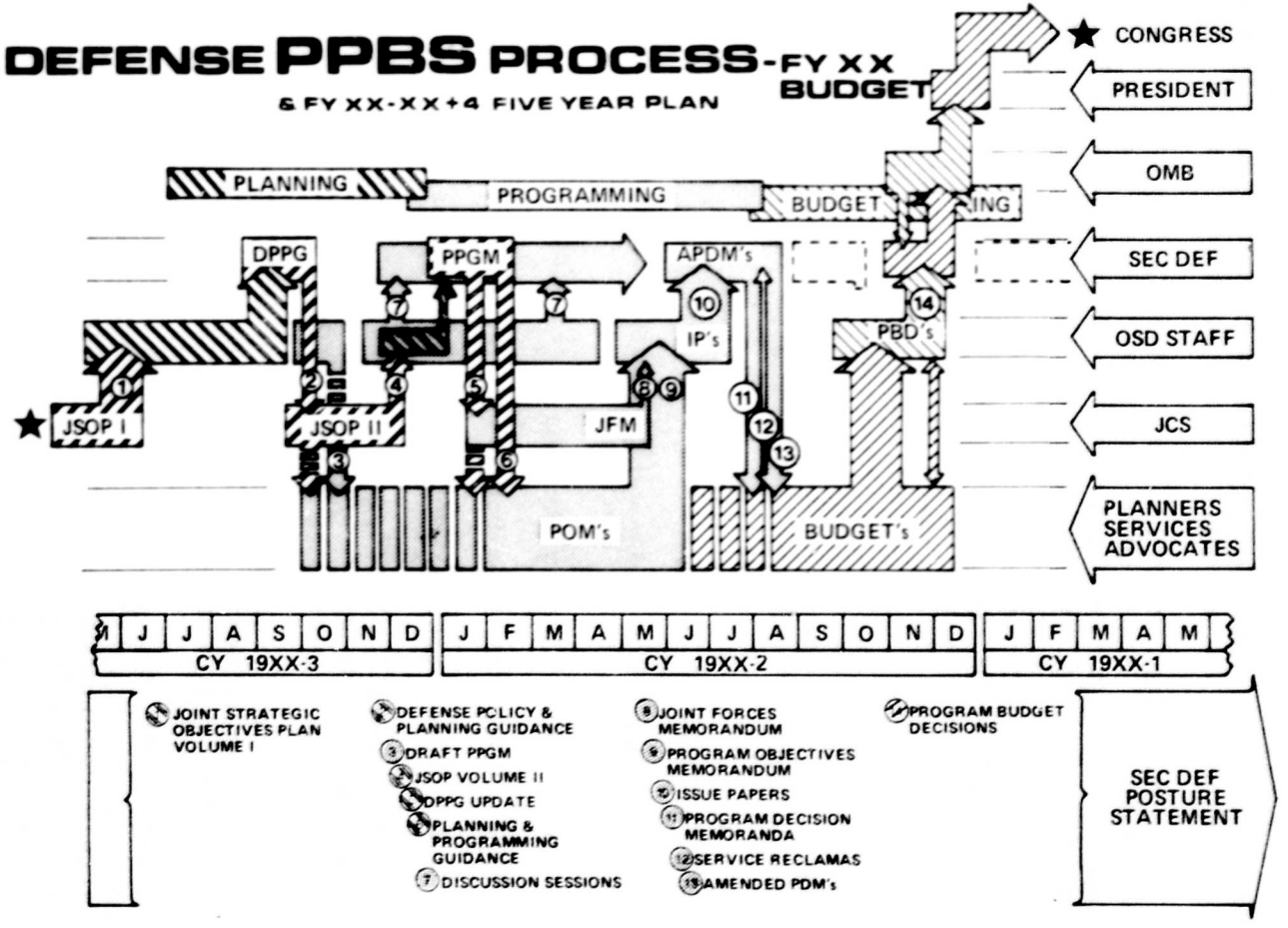


Figure 1. Defense PPBS Process

exercised by DDR&E and Headquarters USAF, as well as AFSC relative to the individual AFATL programs. Typically, the information exchange required for funding and management decisions on a specific program is transmitted vertically through each tier of the organization structure of DoD.

In addition to the formal planning and requirement documents, DoD conducts a series of reviews, known as DSARCs, for major or high importance programs. DoD identifies five phases in the life cycle of a system: conceptual, validation, full scale development, production, and deployment. DSARC I is intended as a review of the conceptual phase and provides the approval for the initiation of the validation phase. This is planned to occur in about the middle of the advanced development effort. DSARC II reviews the validation phase and provides the approval for the full scale development under engineering development funds. DSARC III reviews the previous phases and provides the approval for production funding. Funds for production are in a different category than research and development funds.

2. USAF AND AFSC LEVEL PLANNING

The Air Force planning process, as shown in Figure 2, is initiated by three basic sources:

- DoD Planning Documents
- JCS Planning Documents
- Operational needs or deficiencies.

The operational needs or deficiencies are formally documented as Required Operational Capabilities (ROC) and ultimately consumated as funded programs (Figure 3).

Exploratory development in the USAF originates from the technology needs (TN) which are prepared by Product Divisions, Test Centers, and Laboratories. Laboratory TNs are published in one volume by AFSC. TNs originated by Product Divisions and Test Centers are forwarded to the appropriate Air Force laboratory for comment, and, under certain conditions, a Best Preliminary Estimate (BPE) is made by the laboratories. The laboratory supplied information is included in the published TN and the effort that needs to be expended by the AF laboratory is included in the laboratory Fiscal Year Plans, if it is exploratory

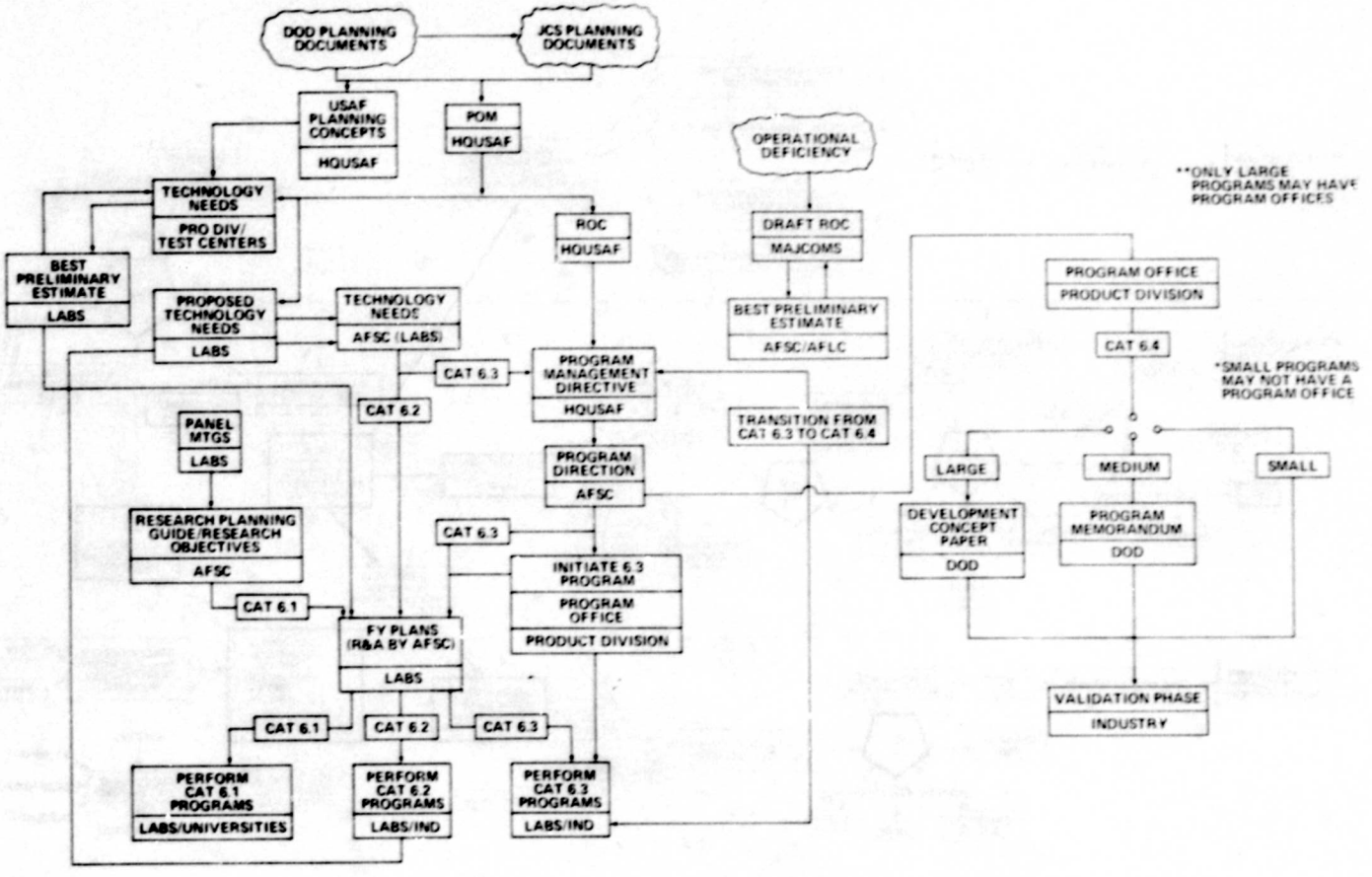


Figure 2. USAF Documentation and Review Procedure

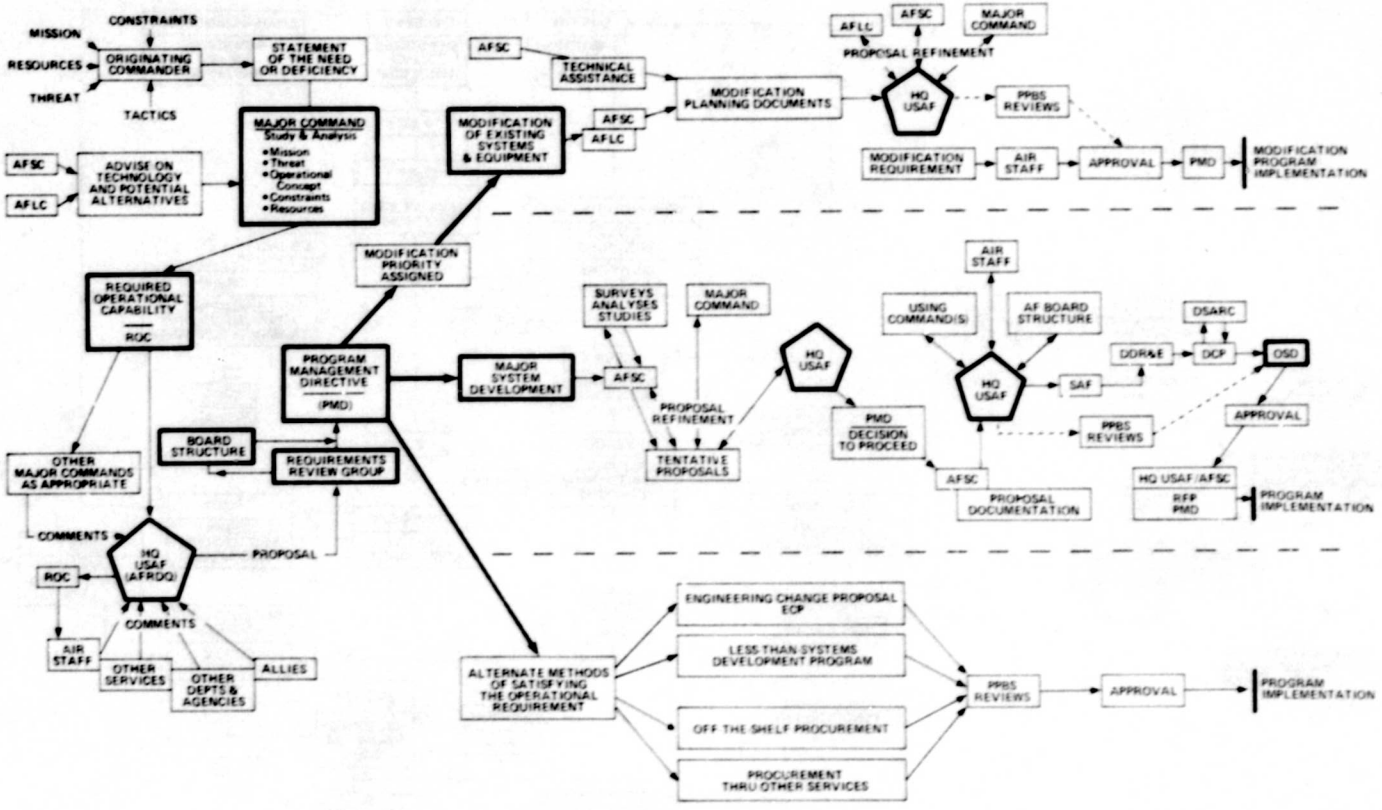


Figure 3. USAF Requirements Process

development. After review and approval of the laboratory Fiscal Year Plans, the technical effort is performed by the laboratory. For a program to transition from Exploratory Development to Advanced Development in the Air Force, one route is for the program to be submitted as a Technology Need with the technical base required for an Advanced Development Program.

USAF Advanced Development Programs can be originated from two primary sources: 1) TN, or 2) an ROC. For Advanced Development Programs, Headquarters USAF prepares a Program Management Directive (PMD). AFSC provides additional guidance in AFSC Form 56 entitled "Program Direction" which is sent to the appropriate Product Division. If a laboratory is involved and the program originates from a TN, a USAF laboratory may prepare a Best Preliminary Estimate. The effort required is included in the laboratory Fiscal Year Planning and is reviewed and approved by AFSC. The Product Division may establish a Program Office, depending on the size and importance of a particular program. Provisional Program Offices are occasionally established before a Program Office is chartered. The Product Division lets contracts to industry for the technical effort. At the conclusion of an Advanced Development Program, the Program Management Directive is updated in preparation for an Engineering Development Program.

A synopsis of an educational brochure developed for the Air Staff Posture Team is provided in Appendix A. This brochure explains the preparations and participation required by the legislative portion of the planning process. It provides a description of the material required for hearings before the Congress and Congressional committees and subcommittees.

3. AFATL LEVEL PLANNING

The AFATL planning cycle is an annual process that results in the laboratory's Five Year Research and Technology Plan. This plan is based upon the Commander's Approved Program (CAP) that identifies the programs that are to be implemented. The planning cycle is initiated 2 years in advance of the implementation of the approved programs and is a dynamic process requiring continuing revisions and updates to the plan because of frequent changes in funding levels, priorities, and schedules.

The current AFATL Planning Process is initiated at the AFATL division levels. Following a status review of the current assigned programs and a review of guidance and requirements documentation, each division synthesizes the programs it desires to advocate. The AFATL Technical Advisory Board (TAB) then reviews the programs to assess the technical feasibility. The TAB recommendations are forwarded to the AFATL Executive Council which is responsible for the development of CAP. After the CAP is approved by the AFATL Commander, it is submitted for review and approval by AFSC/DL. From the approved CAP, the Munitions Development Plan (MDP) is formulated by the AFATL divisions for programming.

The AFATL function relative to the PPBS is the scheduling and allocation of the resources necessary to accomplish the objectives of the AFATL Corporate Plan.

4. PLANNING CYCLE SIGNIFICANT EVENTS

The DoD Planning, Programming, and Budget System is a continuous process which supports the Secretary of Defense in the formulation of the Defense Research and Development Program. The process spans a 30-month period from the time the Joint Chiefs of Staff commence developing the Joint Strategic Objectives Plan until the funding appropriation bill is approved. Almost 24 months elapse before the budget is submitted to Congress by the President. The remaining time is involved with posture, authorization, and appropriation hearings and Congressional Committees' conferences and reports.

The primary planning instruments which are formulated during the FY XX+3 budget development process along with the period of development and the responsible agency is provided in Table 1 and also presented schematically (Figure 4) on a time line chart. Within the confines of these presentations, Air Force is construed to include AFSC, as well as Headquarters USAF.

TABLE 1. PLANNING INSTRUMENTS

PLANNING INSTRUMENT	DEVELOPMENT PERIOD	RESPONSIBLE AGENCY
Joint Strategic Objectives Plan (JSOP) Volume I	April - June FY XX	Office of Secretary of Defense (OSD)
Defense Policy and Planning Guidance (DPPG)	August - September FY XX	OSD
JSOP Volume II	October - December FY XX + 1	OSD
Planning and Programming Guidance (PPGM)	December - February FY XX + 1	OSD
Joint Forces Memorandum (JFM)	January - May FY XX + 1	OSD
Program Objectives Memorandum	February - June FY XX + 1	Air Force
Issue Papers (IP)	May - July FY XX + 1	OSD
Program Decision Memoranda (PDM)	June - August FY XX + 1	OSD/ Air Force
Commanders Approved Program (CAP)	February - August FY XX + 1	AFATL
Budget Formulation	June - September FY XX + 1	Air Force
Program Budget Decisions (PBD)	October - December FY XX + 2	OSD/ Air Force
Budget Actions	November - December FY XX + 2	OMB
Budget Review and Presentation	December - February FY XX + 2	President
Hearings	February - September FY XX + 2	Congress

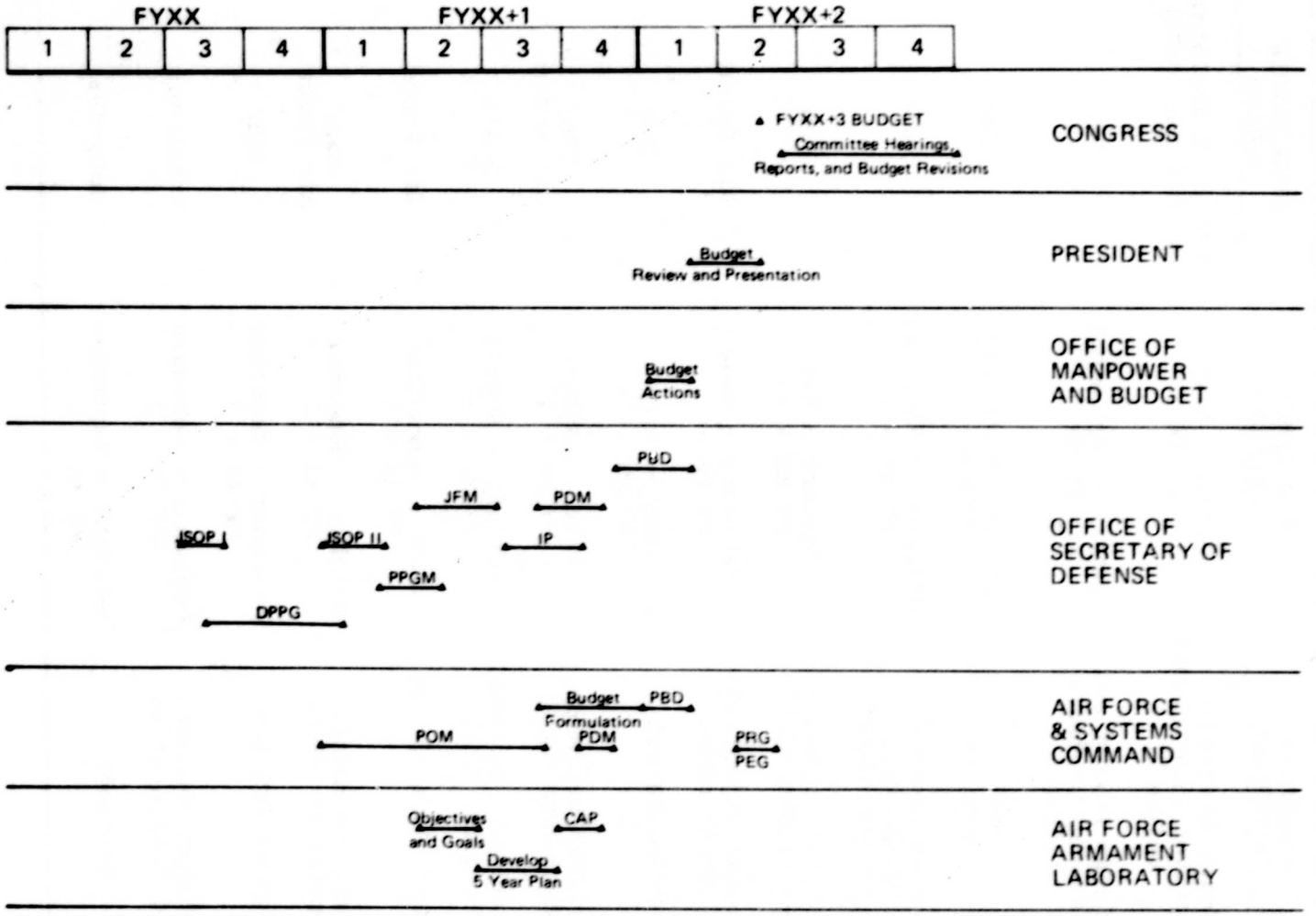


Figure 4. Planning Schedule

SECTION IV

PLANNING DOCUMENTS

The basic documents which provide the guidelines for the AFATL planning process are discussed briefly in the subsequent paragraphs of this section.

1. JOINT RESEARCH AND DEVELOPMENT OBJECTIVES DOCUMENT

The Joint Research and Development Objectives Document (JRDOD) is prepared by the Joint Chiefs of Staff (JCS) to provide advice and assistance to the Secretary of Defense in developing the DoD research and development program. The specific purpose of the JRDOD is to translate the JCS strategic appraisal and objective force recommendations into R&D objectives drawn from mission area deficiencies. As such, the JRDOD forms the bridge from objectives planning to initiation of the Defense System Acquisition Review Council (DSARC) process and associated Development Concept Papers. Inputs to the JRDOD are requested from the unified and specified commands, the three military services, and the DoD Agencies. These inputs are evaluated and coordinated by the Joint Staff and approved by the Joint Chiefs of Staff.

2. AREA COORDINATING PAPERS

Area Coordinating Papers (ACP) are published by the Office of the Director of Defense Research and Engineering (ODDR&E) to provide the Secretary of Defense with an overview of research, development, test, and evaluation (RDT&E) efforts in support of a particular mission area. Each ACP identifies requirements for operational capability by comparing them with current RDT&E efforts and projected activites. Additionally, the ACP contains a general program designed to overcome deficiencies and furnish appropriate program guidance to the military services and defense agencies. A primary goal of each ACP is to raise and resolve major issues. Each ACP is coordinated within the Office of the Secretary of Defense and by the military services before publication.

3. TECHNOLOGY COORDINATING PAPERS

In order for the Secretary of Defense to verify to Congress that all research, technology, development, and engineering funds are wisely spent, there is a requirement for a clear overview of the total military technology program. The evolution of the Technology Coordinating Paper (TCP), published by the ODDR&E, was in response to this need. Basically, a TCP is an internal management tool which assesses the technical program, goals, and potential payoff from DoD investment of basic technology program funds (research, exploratory development, and non-systems advanced development funds). The inputs are originally prepared and reviewed yearly for possible revision by teams from the three military services and formally coordinated by the military departments and within the Office of the Secretary of Defense. ODDR&E envisions that TCPs will be used by middle management as an aid in making decisions on the proper allocation of resources for the various technology areas and has directed that they be integrated into the general planning process at the Service Staff and Systems Command level.

4. REQUIRED OPERATIONAL CAPABILITIES

Required operational capabilities (ROC) are the formal documents which identify operational needs and request new or improved capabilities for the operating forces. Capabilities are described in terms of the operational objective, the operational environment, and the concepts of operation, support, and maintenance. Satisfaction of a ROC normally requires a combination of research, development, test, modification, and procurement efforts.

5. PROGRAM MANAGEMENT DIRECTIVES

Program management directives (PMD) are documents prepared by Headquarters USAF to provide formal direction to the implementing and participating commands. They are used during the entire acquisition cycle to state requirements and request studies, as well as to initiate, approve, change, transition, modify, or terminate a program. The contents of each PMD, including the required Headquarters USAF review and approval actions, are tailored to the needs of the specific program.

6. AFSC TECHNOLOGY PLANNING GUIDE, PART I

The AFSC Technology Planning Guide (TPG), an interim product of an evolutionary effort to clearly identify goals for Air Force technology, is the initial step in the planning process. It is a compilation of stated requirements and possible system options related to specific mission areas. In this manner, important needs of technology users are conveyed to the Laboratories. Unfortunately, these needs far exceed the capabilities of the Laboratories to satisfy them and no authoritative system exists for determining the relative priority of the needs. The TPG does, however, provide a method of informing the Laboratories of desired technologies and the time period in which they should be available.

7. AFSC RESEARCH PLANNING GUIDE

This document provides the midterm technological gaps associated with real and conceptual systems, and long-term requirements directed toward scientific opportunities which offer the greatest potential for impacting on future military operations. Each objective contains a short description of its scope, the midterm requirements, the long-term requirements, a listing of source documents and points of contact. If possible, midterm requirements are correlated with research needs stated in Technology Planning Objectives defined by each Laboratory and technology needs submitted to the Laboratories by AFSC organizations. Long-term requirements are based on Air Force scientists' knowledge and evaluation of the scientific areas of greatest activity and potential. Each requirement is classified as to its relative military importance using the priority system of the Joint Research and Development Objectives Document published by the Joint Chiefs of Staff

8. TECHNOLOGY NEEDS

Technology Needs (TN) are documents describing specific items of research and technology required by AFSC organizations for the orderly development of systems, subsystems, or capabilities. The TN program is directed toward identifying and resolving research and technology barriers to future Air Force systems. As such, the program usually results in long-term efforts which can be incorporated in the normal planning and programming of Laboratory projects. When a

technological problem is identified by an AFSC organization, a TN can be originated. The TN normally contains a description of the problem, a categorization of importance relating to the need and timeliness of a required solution, known related efforts, and suggested approaches. The originating organization forwards the TN to Headquarters AFSC/DL, with information copies being provided to those Laboratories having related technical responsibilities. Within Headquarters AFSC/DL, the TN is reviewed by the Technical Directorate (DLC, DLF, DLS, or SGB) having primary technical interest. That Technical Directorate reviews the TN for the purpose of assignment and forwards the TN to the Laboratory (or Laboratories) having the expertise and competence necessary for an appropriate response. The originating organization should be made aware of changes from the suggested assignment within 2 weeks. Laboratories receiving information copies of TNs directly from the originator have the option of replying but are not required to do so unless directed by Headquarters AFSC/DL.

9. PLANNING ACTIVITY REPORT

The AFSC Planning Activity Report (PAR) is published every 4 months by DCS/Development Plans to describe development planning activities under the direction of Headquarters AFSC. It provides a basis for the continuing dialogue between the AFSC planning community, Air Force laboratories, major air commands, and Headquarters USAF by summarizing certain on-going programs, projects, and studies within the responsibilities of the DCS/Development Plans and the Director of Science and Technology. The efforts described in the PAR are those intended to ensure that proposed concepts are compatible with mission requirements, resource constraints, and existing and forecasted technology.

SECTION V

APPRAISAL APPROACH

The Armament Laboratory along with other research and development organizations is continually confronted with the task of determining the most productive allocation of its resources. Annually, the AFATL operating divisions propose a set of development programs which are sequentially reviewed by the Technical Advisory Board (TAB) and the Executive Council. After review by these groups, the candidate programs are consolidated as the Commander's Approved Program (CAP) and submitted to Headquarters AFSC as the Laboratory Commander's Program Advocacy Document.

This effort was initiated to assist in the formulation of a methodology which would provide the capability to increase the objectivity of the process of evaluating and ranking candidate development programs. Additionally, the methodology will provide a capability to appraise ongoing programs and to evaluate their readiness for technology transfer. A typical transfer would be from exploratory to advanced development.

1. THE FRAMEWORK OF R&D PLANNING, APPRAISAL, AND MANAGEMENT

The framework in which R&D planning and appraisal works must be a part of the whole structure. The basic framework and the resulting interactions (Figure 5) is generally the same in all R&D organizations.

The management of the organization should take upon itself the responsibility or staff function of determining what requirements, intelligence, and guidance should be given to the rest of the organization. Management is charged with making the final decision as to allocation of resources. The R&D group performs the function of determining what the systems and technology needs are, appraising the needs versus the program to see if it is responsive, and then negotiating approval. Once the program is approved, implementation is handled by the technical community. These people help identify technological opportunities and new concepts and develop work proposals. The key to the process is that these work proposals respond to stated, justified program needs and not the converse. However, innovation is fostered by the fact that development needs do consider technical contribution of new concepts as will be shown on the following page.

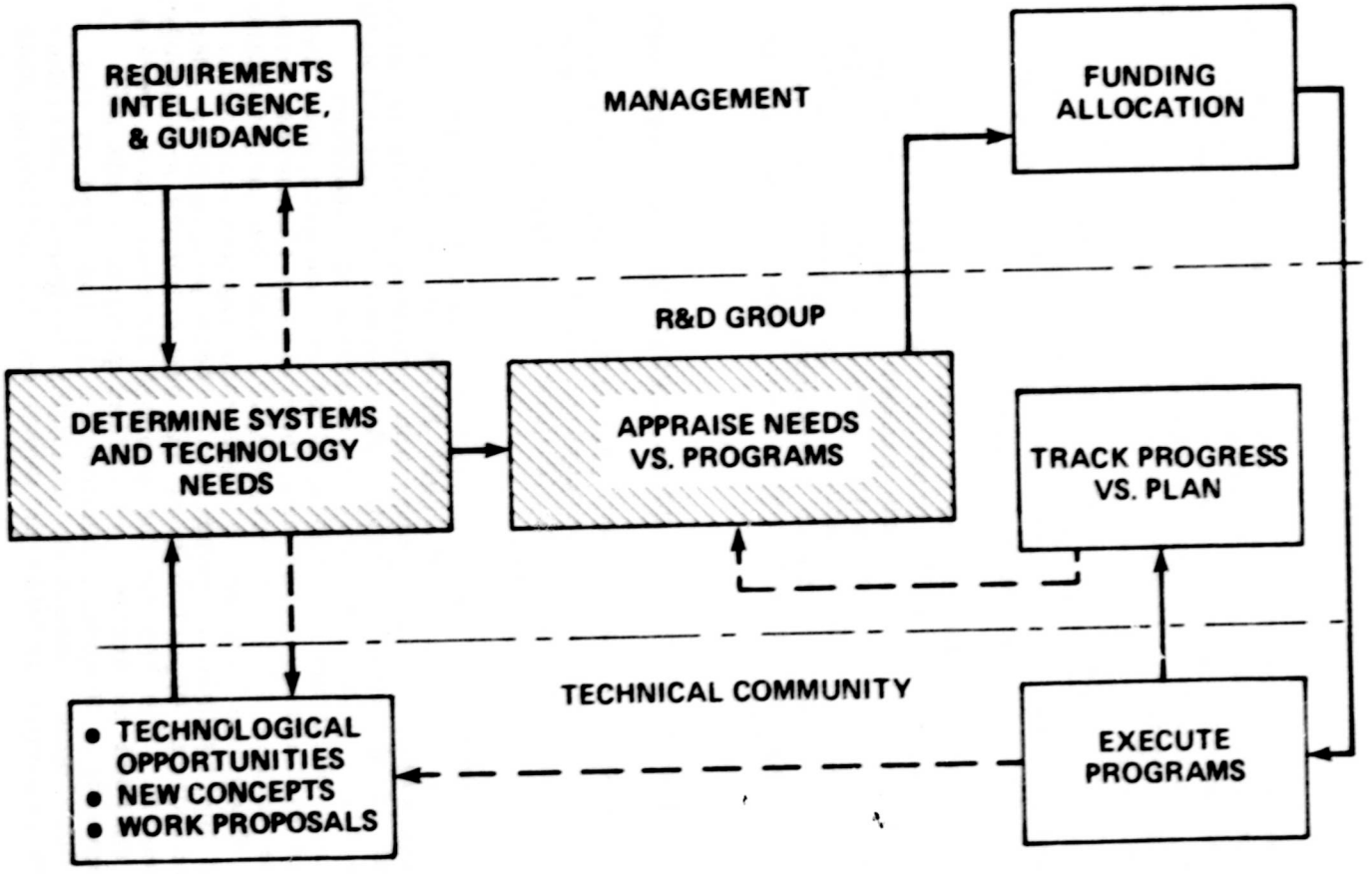


Figure 5. Framework of R&D Planning, Appraisal, and Management

2. OVERVIEW OF AN APPRAISAL PROCESS

The appraisal process entails extensive use of panels and committees (Figure 6). A realistic grouping of performers encompasses the use of appraisal panels, an integration committee, an R&D review board, and an R&D council. Within the organizational structure of the AFATL, the role of the R&D review board can be filled by the TAB, and the Executive Council will suffice for the R&D Council. The Integration Committee, which could be the Standing Planning Group or a select team from the Analysis Division (DLY), would be charged with responsibility for implementing the appraisal methodology.

3. ELEMENTS OF THE APPRAISAL METHODOLOGY

The basic elements of an appraisal methodology as conceived for this and previously accomplished efforts of a similar nature include:

- Expert judgement maximally aided by analytical techniques
- Use of ranking and weighting for selected evaluation factors
- Application of expert opinion through the use of a panel of technologists
- Aggregation of results
- Presentation and application.

The panel members establish ranking and weighting for each project against selected evaluation factors. The results are then aggregated by the hierarchy of panels and review groups as presented in the Overview of an Appraisal Process. Finally, the Integration Committee has the responsibility for documenting the results and supervising the application.

4. APPRAISAL CRITERIA

Instrumental to the development of a workable methodology is the identification of suitable criteria for assessing the overall merit of candidate programs in the context of:

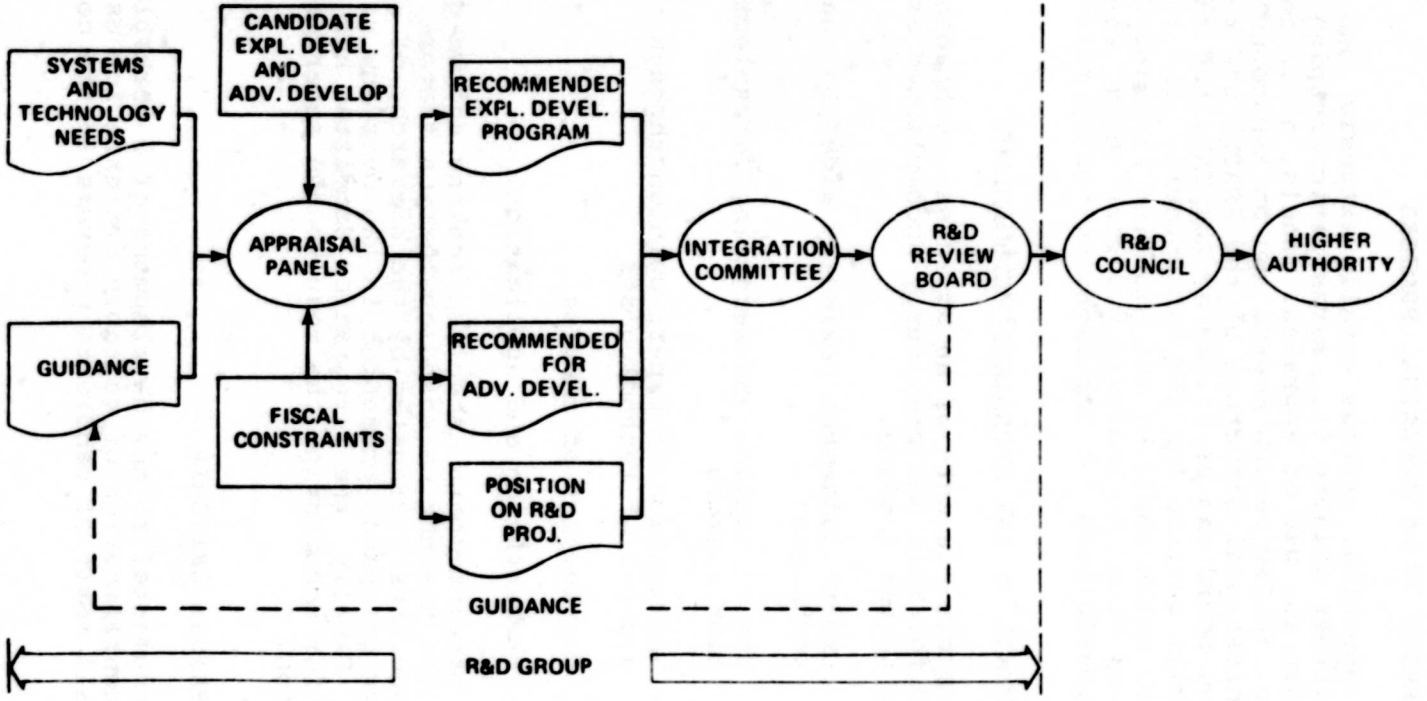


Figure 6. Overview of Appraisal Process

- Technological feasibility
- Mission contribution aspects
- Potential operational utility
- Technical risk
- Return on investment
- Criticality to system development
- Uniqueness.

A basic set of appraisal criteria which encompass the above features were developed and are discussed in the following paragraphs. The appraisal criteria are to be for assessing and subsequently ranking proposed development programs. The ranking process will be accomplished at the task level which past experience has shown to be adequate.

The appraisal criteria are presented below and are accompanied by supporting rationale and a logic and thought process to guide their application in evaluating proposed programs. The basic criteria proposed here and which will be discussed on an individual basis in subsequent paragraphs are:

- Need or utility
- Return on investment (ROI)
- Uniqueness.

a. Need or Utility

The candidate tasks will be evaluated on an individual basis to determine the urgency of the need. A task will be assessed on the potential to counter a projected threat on both the near-term and long-term basis. Need is a composite of a number of influencing factors. The factors which must be combined to properly assess the urgency of a need have distinct interrelationships (Figure 7).

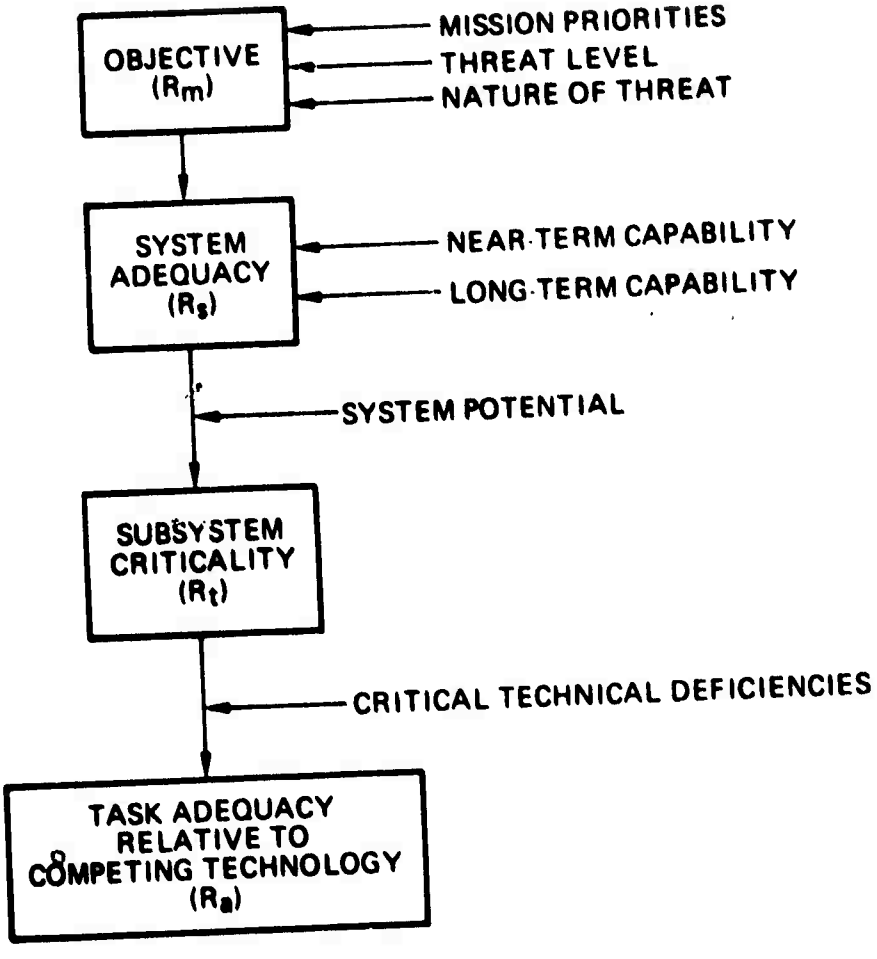


Figure 7. Need or Utility

The objective factor is in itself a composite of other elements. It combines the urgency of the operational mission with the specific objectives relative to a specified category of targets. The ranking of this factor entails consideration of the threat level and type and the priorities which relate the target categories to an operational mission.

The Generic Weapons System factor addresses the adequacy of a type system that has been in use, is in use, or will probably be used in the future. A system is evaluated as to its probability of alleviating a recognized deficiency in capability. The system may provide an enhancement to an existing capability or it may generate a new capability.

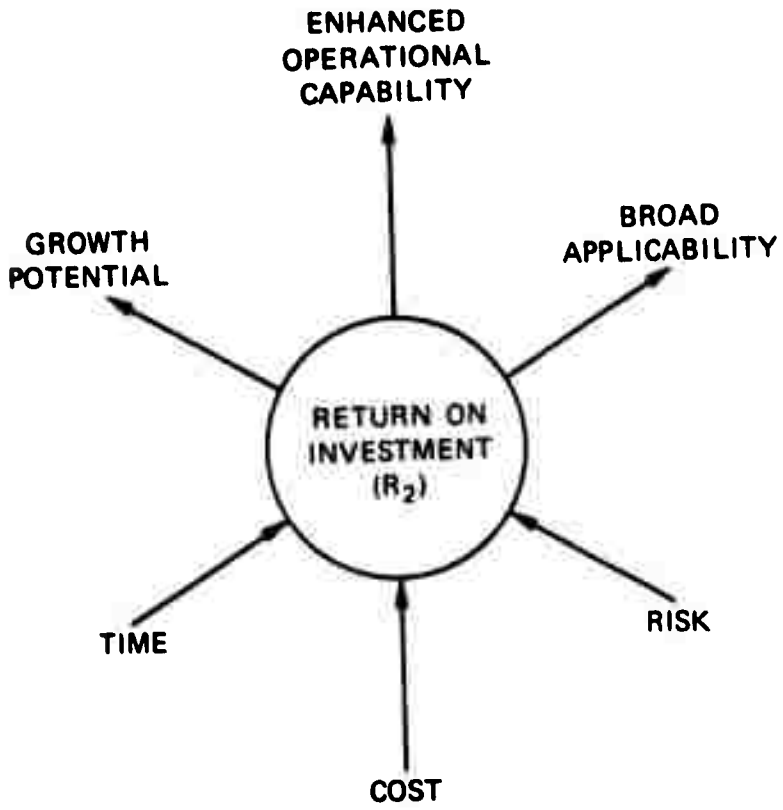
The subsystem evaluation factor is the evaluation of the dependency of a particular generic weapon system to a specific subsystem technology. Crucial issues in this evaluation include the criticality of the subsystem to the system's performance and whether the necessary technology will be available in sufficient time to avoid delaying the system's readiness.

The task area factor is concerned with the impact of the task on the subsystems and their related technologies. The timeliness of a task in meeting the system's needs by providing a mature technology is a critical factor in the evaluation. Additionally, the importance or relative merit of a task when compared to a competing technology is a critical consideration in the ranking process.

b. Return-on-Investment

This criterion addresses the crucial issues of realism (Figure 8). It is primarily concerned with how well the program pays off or succeeds. This factor requires an evaluator to exericse a level of mental integration beyond that required for the ranking process applied to other criteria. The factor could be broken down into subfactors with ranks and weights assigned to each; however, in the interest of simplicity and supported by a strong consensus rationale statement, mental integration appears satisfactory for this methodology in its embryonic stage. The key aspects for consideration in terms of ROI are the growth potential of the technologies involved, the current and projected costs, the applicability to other efforts, the time since inception and the time left to completion, and the technical risk associated with the effort.

RETURN ON INVESTMENT



- ROI -- A COMPLEX FACTOR NOT EASILY BROKEN DOWN INTO CONSTITUENTS
- COMPOSITE ANSWER TO QUESTIONS:
  - IS THE PROGRAM REALISTIC IN COST, SCHEDULE, AND RISK?
  - IS THE PROGRAM WELL MANAGED?
  - DOES IT OFFER A POSITIVE PAYBACK RATIO?
  - DOES THE GROWTH POTENTIAL JUSTIFY SOME RISK?

Figure 8. Return on Investment

c. Uniqueness

This criterion addresses the availability of the desired technology from a source external to AFATL. Obviously, if the technology is available from other sources within the Air Force, the Department of Defense as a whole, or other Government agencies such as NASA, then the proposed program should have a low priority within AFATL. If the technology is available from domestic or foreign industry, then other aspects, such as cost and availability must be considered, but, typically the priority or ranking is higher. Finally, if the technology is not available from any source then it must receive the highest rank.

5. FACTOR RANKING AND WEIGHTING

The appraisal criteria or factors must be ranked on an individual basis and weighted in accordance with their respective importance. The criteria and their accompanying symbols for ranking and a suggested weighting for each are provided in Table 2. The criterion of need or utility is comprised of four constituent elements each of which also assigned a ranking symbol but no weighting factors since need or utility is ultimately scored as an entity. The constituent elements of need or utility are combined and normalized to provide a single value.

TABLE 2. APPRAISAL PARAMETERS

CRITERION	RANK SYMBOL	CONSTITUENTS	RANK SYMBOL	WEIGHT FACTOR
Need or Utility	R_1	Objective	R_m	3
		Generic System	R_s	
		Subsystem	R_t	
		Task Area	R_a	
Return on Investment	R_2			2
Uniqueness	R_3			1

The three primary appraisal criteria need or utility (R_1), return-on-investment (R_2), and uniqueness (R_3) are weighted 3, 2, 1, respectively, because:

- Need or utility implies a capability for mitigating an actual or projected threat. This is considered the primary concern for the related R&D efforts.

- Return-on-investment is reflective of economical and efficient development. This is considered a major concern for the related R&D efforts.

- Uniqueness has been weighted 1 since redundant effort is not necessarily an item of major concern.

6. RELEVANCE TREE FOR AIR DELIVERED NONNUCLEAR ORDNANCE

The appraisal criteria provided in the preceding section are to be applied to individual tasks to evaluate their worth or merit in support of the Air Force's ability to successfully perform missions that require the use of conventional munitions. A relevance tree (Figure 9) was constructed to provide a better insight into the rationale supporting the various development efforts associated with nonnuclear munitions and related equipment. The top five levels of the relevance tree are discussed in the following paragraphs. The levels for Generic Weapons Systems and program formulation, with accompanying synthesis and analysis, is considered self-explanatory.

a. Air Force Goals - Level 0

The goals are descriptive of the type forces that must be maintained to enforce our national strategy of realistic deterrence and its accompanying central concept of total force planning. These goals are accepted as necessary to support national policy and, as such, are not considered during the ranking process. The goals are identified as:

- Strategic Capability: Maintaining a strategic force that has sufficient capability to deter a global conflict but sufficient strength to prevail should deterrence fail.

- General Purpose Capability: Maintaining a force that will contribute to the deterrence of war at lower levels where U.S. national interests are involved.

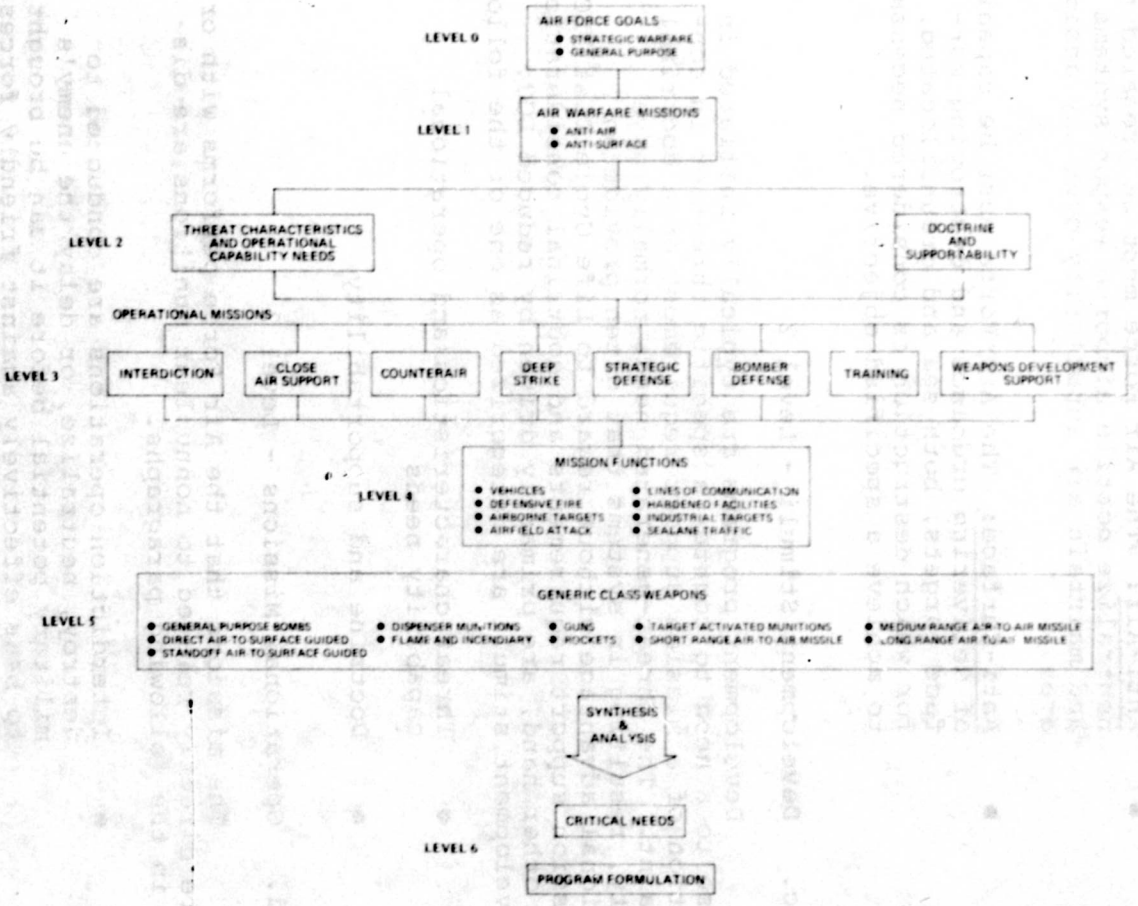


Figure 9. Air Delivered Nonnuclear Weapons Relevance Tree

b. Air Warfare Areas - Level 1

The basic warfare areas of the Air Force can be defined in simple and broad terms as:

- Anti-Air: The Air Force must be prepared to neutralize hostile airborne weapon systems and maintain air superiority over any designated area.

- Anti-Surface: The Air Force must be capable of delivering ordnance and destroying surface targets, both sea and ground located, for which destruction is considered necessary to achieve a specified objective.

c. Development Stimuli - Level 2

Development programs are typically initiated in response to a need to counter a specific threat or in consideration of a mission support requirement or a doctrinal constraint. The threat-generated needs normally have priority, resulting in systems that often provide an operational advantage without regard to Life Cycle Cost (LCC). The mission support requirements and doctrinal considerations, on the other hand, are primarily driven by reduced LCC. The development stimuli are categorized as one of the following:

- Threat characteristics and operational capability needs

- Doctrine and supportability

d. Operational Missions - Level 3

The missions that the Air Force performs with or that are directly related to nonnuclear munitions are discussed in the following paragraphs.

- Interdiction operations are conducted to destroy, neutralize, or delay the enemy's military potential before it can be brought to bear effectively against friendly forces. A properly planned air interdiction campaign can deny the availability or movement of appreciable quantities of personnel and material. Interdiction missions can be

either air strikes against specific targets or armed reconnaissance missions with the purpose of locating and attacking targets of opportunity.

- Close Air Support responds directly to the ground battle commander's requests either as part of a previously coordinated ground-air operations plan or as immediate time-urgent contributions to assist the ground unit in combat contingencies. Specifically included are harrassment, neutralization, and destruction through air attack on enemy ground forces in close proximity to friendly forces. Specific tasks of close air support forces include:

  - Close supporting fire against targets in immediate contact with friendly surface forces.

  - Escort and suppressive supporting fire for airmobile and airborne forces and providing surveillance and security for landing forces, patrol, and probing operations.

- Counter Air has the objective of gaining and maintaining air superiority to prevent enemy forces from interfering with friendly air and surface operations. This objective is accomplished through the destructive or neutralization of the enemy's air offensive and defensive systems. Since the presence of enemy air power constitutes a significant threat to both air and surface forces, counter air operations may demand the highest priority of all types of air operations. Counter air missions include fighter sweeps, screens, combat air patrol, air escort, air intercept, and counter-air-strikes. Counter-air-strikes include strikes against enemy bases, aircraft. air defense weapons, and control systems.

- The deep strike missions are performed well beyond the forward edge of the battle area (FEBA) and directed primarily against industrial and military target systems.

- Strategic defense is, in essence, the mission to protect the United States and its forces. It requires that the capability be developed and maintained to destroy, reduce, or otherwise negate enemy attack forces. It requires that in the event an attack is consumated, the forces that survive can be reconstituted into a viable defense force. A nonnuclear capability against satellites is a requirement of this operational mission.

- Bomber defense is that operational mission to protect our manned bomber force in order to allow a successful attack against enemy targets. This mission requires that capabilities to defend the bomber force against enemy aircraft (air-to-air weaponry and surface-to-air weaponry) be developed and maintained.

- Training enhances mission effectiveness by providing necessary skills to the required number of people at the time they are needed.

- Weapons development support is the synthesis and analysis required to support both ongoing and conceptual efforts. Threat levels are evaluated to identify the precise needs, and performance capabilities are evaluated to determine the probability of a system being adequate to satisfy the needs.

e. Mission Functions (Level 4)

This level was inserted into the relevance tree during the latter stages of the effort. The Director of Research and Plans implemented the technique of planning for accomplishing a set of specially conceived objectives and goals. This technique appeared very compatible with the relevance tree approach and was inserted at the next lower level from Operational Missions. The functions and missions interact closely with most functions impacting on more than one mission (Figure 10). The areas and general objectives, as presently perceived within the AFATL, are:

OPERATIONAL MISSIONS / MISSION FUNCTIONS	CLOSE AIR SUPPORT	COUNTERAIR	INTERDICTION	DEEP STRIKE	STRATEGIC DEFENSE	BOMBER DEFENSE
VEHICLES	★		★	★		
DEFENSIVE FIRE POWER	★	★	★	★	★	★
AIRBORNE TARGETS		★				★
AIRFIELDS		★		★		
LINES OF COMMUNICATION			★	★		
HARDENED FACILITIES	★	★	★	★		
INDUSTRIAL TARGETS			★	★		
SEA LANE TRAFFIC				★		

Figure 10. Relationship Mission Functions Versus Operational Missions

- Vehicles. The objectives for this area are the immobilization or otherwise neutralization of vehicles operating within the first echelon, prevention of second echelon reinforcement of forward battle areas, and the disruption and disorganization of staging areas.

- Defensive Fire Power. The objectives for this area are the neutralization of defensive fire impeding friendly frontal activities and neutralization of surface-to-air defenses impeding friendly air penetration to enemy rear areas.

- Airborne Targets. The objectives for this area are to neutralize enemy air operations in friendly air space and to assure friendly air operations against the enemy rear.

- Airfields. The objective for this area is to reduce the enemy Air Forces sortie generation rate.

- Lines of Communication. The objective for this area is to deny the enemy coordinated movement of supplies and equipment to staging and frontal areas.

- Hardened Facilities. The objectives of this area are to deny the enemy use of battlefield fortifications which impede friendly ground operations and to neutralize enemy air defense network fortifications throughout the enemy rear.

- Industrial Targets. The objective for this area is to reduce the ability of the enemy to produce and supply war materials.

- Sealane Traffic. The objectives for this area are to deny the enemy the use of sealanes as major supply routes and to neutralize enemy ships operating on the open seas.

7. APPRAISAL PROCEDURE

Panels will be the key means used for appraising the candidate development programs. The panels, which are comprised of experienced technical personnel, will be provided with appropriate input material relative to developmental goals and capability deficiencies. From this basic material, the panels will evaluate the candidate programs against the appraisal criteria. The overall appraisal scoring concept is presented schematically in Figure 11. Specific comments relating to the appraisal factors are presented in subsequent paragraphs.

a. Need

- Both near-term and long-term needs are provided for each mission area.
- The need for a program is determined by assessing the importance of the related mission, the adequacy of the proposed system, the criticality of the subsystem and the proposed/ongoing project support to the subsystem.
- Values of 3, 2, 1, or 0 are assigned to mission importance (R_m), system adequacy (R_s), subsystem criticality (R_t), and task impact (R_a) using the criteria provided in Table B-1 of Appendix B.
- The product of R_m, R_s, and R_t is the path scoring of need for a subsystem. This product multiplied by the impact of each task (R_a) provides a score for each task which is supportive of the subsystem. These scores are then normalized to a value (R_1) of 3, 2, or 1 based upon their assignment to a portion of the need normalizing curve (Figure 10) by the appraisal panel. This value multiplied by the weight of need (W = 3) provides the need score for each task. The need score ($3R_1$) is combined additively with the return on investment ($2R_2$) and uniqueness (R_3) scores to develop an overall task value score.

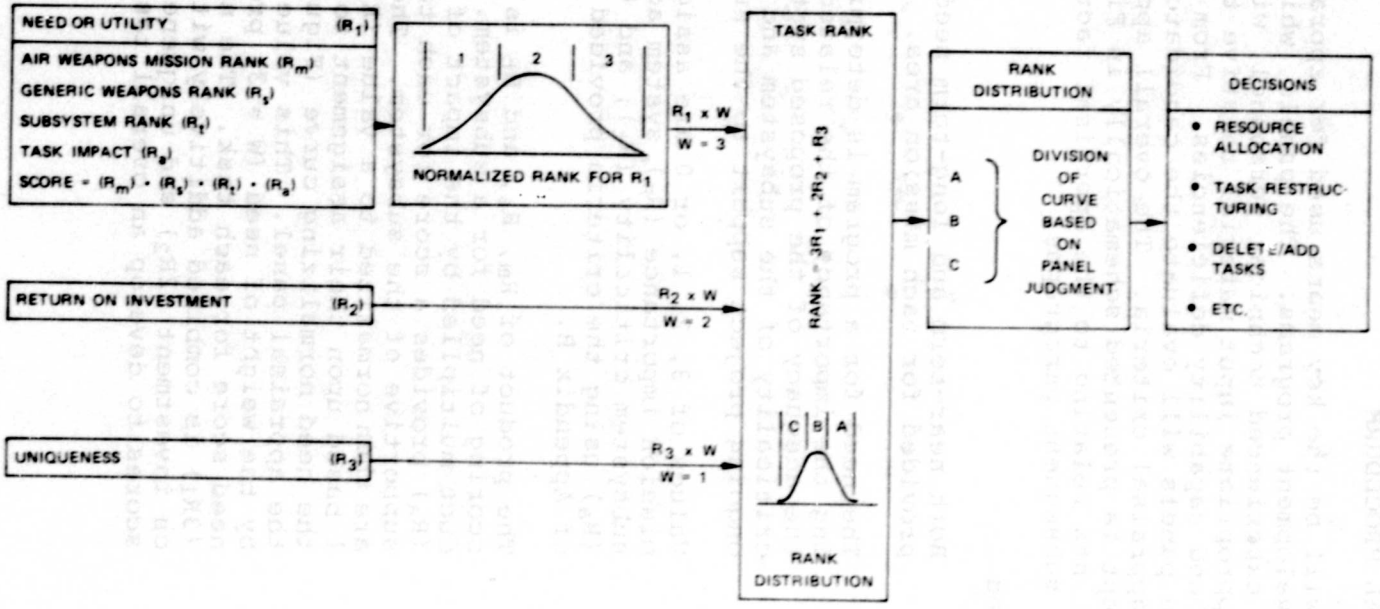


Figure 11. Appraisal Technique

b. Return-on-Investment (R_2)

This factor is ranked directly through a process of mental integration using the criteria provided in Table B-2 as scoring guidelines. These guidelines have evolved over a number of years during the evaluations of numerous R&D efforts. The use of the suggested guidelines is predicated upon the assumption that the initial planning reflected an accurate and realistic assessment of program cost, schedule, and technical risk.

c. Uniqueness of the Technology (R_3)

This factor is ranked directly using the criteria presented in Table B-3. The numerical value of the ranking is inversely proportional to the availability of the technology. If the technology is not available from any source the highest numerical rank value is assigned. When the technology is available from another Governmental source, then the lowest numerical rank value is assigned.

SECTION VI

APPRAISAL ALOGRITHMS AND EXAMPLES

This section contains the algorithm developed for the appraisal of AFATL programs and examples to illustrate its application. The examples are complemented with numerous figures and tables which are grouped according to their function into separate appendices. References to the appendices are made by the appropriate figure or table number. The appendices are listed and discussed in Table 3. This section is presented in three parts which are:

- Algorithm
- Application of the appraisal algorithm
- Appraisal of a selected program.

A step-by-step procedure for the appraisal algorithm is presented in paragraph 1 and lists the algorithm steps in an abbreviated form. Each step of the procedure is fully explained in paragraph 2 by an example which illustrates the application of the appraisal algorithm to a particular relevance tree path. The example in paragraph 3 is an alternate approach to the relevance tree evaluations. In this example, a particular program was evaluated for each applicable path of the relevance tree. This approach will produce the same results of the previous example, but will provide a more task oriented evaluation than the process described in paragraph 2.

1. ALGORITHM

The successful application of the appraisal technique requires a systematic procedure for applying it. A 13-step algorithm has been developed for the application. The step-by-step procedures are:

- Step 1. Summarize requirements and deficiencies for the Operational Mission/Mission Function segment of the relevance tree path.
- Step 2. Determine R_m-value and develop rationale.

TABLE 3. LISTING OF APPENDICIES

APPENDIX	TITLE	CONTENTS
B	Ranking Criteria	Tables B-1, B-2, and B-3 contain criteria for Need, Return-on-Investments, and Uniqueness parameters. Table B-1 (Need) is divided into separate criteria for: Objective Rank Generic Weapons Class Subsystem Task-Area Impact.
C	Summaries of Requirements, Capabilities, and Deficiencies	Requirements with applicable operational missions are summarized for each Mission Function. Table C-1 identifies capabilities and deficiencies for each Generic Weapon System. Table C-2 combines Requirements, Deficiencies, and Operational Missions for the example appraisal. The table is divided into three parts: Mission Function, Generic Weapons, and Subsystem.
D	Example Worksheets for the Appraisal	Figure D-1 shows a completed Appraisal Worksheet for the first example. Figure D-2 shows completed Appraisal Worksheets for the second example - one for each relevance tree path used in the example.

TABLE 3. LISTING OF APPENDICIES
(Continued)

APPENDIX	TITLE	CONTENTS
D	Example Worksheets for the Appraisal (Concluded)	Table D-1 contains the Reduction Matrix for the example. Table D-2 contains the Return-on-Investment worksheet to be used in evaluating R_2.
E	Program Data for the Appraisal	Figure E-1 contains a Program Data Sheet developed for the example. Figure E-2 shows a completed data sheet for the Return-on-Investment evaluation.
F	Example Program Listings and Rationale Tables	Figure F-1 shows a format used in listing candidate programs and their R-values for the relevance tree path used in the first example. Figure F-2 shows the second example program with its R-values for each of its relevance tree paths. Table F-1 lists the rationale developed for the examples. The table is divided into sections for Mission Functions, Generic Weapons, Subsystems and Tasks.
G	Example of Prioritization of Programs	Table G-1 shows an example prioritization of programs.

TABLE 3. LISTING OF APPENDICIES
(Concluded)

APPENDIX	TITLE	CONTENTS
H	Expanded AFATL Relevance Tree and Appraisal Code	Figure H-1 illustrates the expanded AFATL relevance tree. Figure H-2 describes the code to be used for computerization of the appraisal.

- Step 3. Summarize requirements and deficiencies for the Operational Mission/Mission Function/ Generic Weapon segment of the relevance tree path.
- Step 4. Determine R_s-value and develop rationale.
- Step 5. Summarize requirements and deficiencies for the Operational Mission/Mission Function/ Generic Weapons/Subsystem segment of the relevance tree path.
- Step 6. Determine R_t-value and develop rationale.
- Step 7. Review Program Data Sheets for the candidate programs.
- Step 8. Determine R_a-values and develop rationale.
- Step 9. Organize results.
- Step 10. Compute and normalize raw score for determination of R_1-value.
- Step 11. Determine R_2-value and develop rationale.
- Step 12. Determine R_3-value and develop rationale.
- Step 13. Compute rank value and prioritize programs.

2. APPLICATION OF THE APPRAISAL ALGORITHM

A typical example was developed for demonstrating the applications of the appraisal algorithm. Initially a path was constructed through the Air Delivered Nonnuclear Weapons relevance tree from level zero to level six. For the example, the following situations were selected for each level.

LEVEL	SITUATION
0	General Purpose
1	Anti-Surface
2	Threat Characteristics and Operational Capability Needs
3	Deep Strike

LEVEL	SITUATION
4	Defensive Fire
5	Stand-off Air-to-Surface Guided
6	Guidance

Scores were assigned at the applicable nodes as designated by the specific path (Figure D-1). The assigned scores, while constituting realistic values, were not derived by a panel of technical experts as would be the case in an actual appraisal. The step-by-step algorithm, as applied, is presented below with a scoring summary at the end.

- Step 1. The information that is necessary to develop the relationships and interactions between the mission functions and the related operational missions is collected. Appendix C contains summaries of mission function requirements and generic weapon systems capabilities and deficiencies from which the information is gathered for a specific relevance tree path. The information for the Deep Strike/Defense Fire path is displayed in Table C-2.

- Step 2. The information collected for the operational mission/mission function path is evaluated using the appropriate appraisal criteria (Table B-1). For the example, a value of $R_m = 3$ was chosen. This selection was predicated on the contention that we do not have the capabilities to defeat the defensive fire targets in Deep Strike Missions. The defensive fire targets for Deep Strike Missions are hardened SAM sites for which we do not have the required destruction capabilities for the target nor the long range, all-weather guidance required for Deep Strike missions. Thus, the criterion "We fall far short of being able to do the job" applies, resulting in the value $R_m = 3$. A rationale statement for the selected R_m-value is developed. In this example it can be simply stated that we do not have the capability to defeat hardened SAM sites. The rationale is then recorded along with the R_m-value on the Appraisal Worksheet. Figure D-1 contains the Appraisal Worksheet with the R-values and rationale for the example.

- Step 3. The information that is necessary to develop the relationships and interactions between the operational mission/mission function path segment and the related generic weapons is collected. Table C-2, developed for the example, provides the information from which more specific data for the generic weapon evaluation is obtained. The continuation of Table C-2 contains the data necessary for the evaluation of the Deep Strike/ Defensive Fire/Stand-Off Guided Weapon segment of the relevance tree path.

- Step 4. Using the appropriate Appraisal Criteria (Table B-1), the information collected in Step 4 is evaluated. For the example, a value of $R_s = 2$ was chosen. This value was selected because integration of a warhead into a stand-off guided weapon to provide the capability of destroying hard targets is foreseen only in the long-term. Although the required guidance capabilities may be available in the near-term, the capability to defeat the hardened SAM sites will not be a reality until the hard structure warhead is integrated into the weapon system. Thus, the criterion of "the generic weapon offers a high probability of filling the need in the near-term or long-term but not both" applies resulting in the values $R_s = 2$. A rationale statement for the selected R_s-value is developed. The rationale statement derived for the example was based upon the hard-structure warhead deficiencies and is recorded in Figure D-1.

- Step 5. The information that is necessary to develop the relationships and interactions between the operational mission/mission function/generic weapon path segment and the related subsystems is collected. For the example, this information is provided by the Requirements and Deficiencies table for Generic Weapons (Table C-2). From this table, the information for Requirements and Deficiencies table for the guidance subsystem (Table C-2) was developed for the Deep Strike/Defensive Fire/ Stand-Off Weapon/Guidance segment of the relevance tree path.

- Step 6. Using the appropriate appraisal criteria (Table B-1) establish the proper R_m, R_s, and R_t values to be used in Step 7. For the example, a value of $R_t = 3$ was chosen. This value was selected because the current capabilities of all-weather, long range, highly accurate guidance are extremely limited. The criterion that applies is "the generic weapon will not function without the particular subsystem and the existing state-of-the-art will not produce a satisfactory alternative." Thus, the corresponding value of $R_t = 3$ is assigned to the subsystem. A rationale statement for the selected R_t value is selected. The rationale statement developed for the example is shown in Figure D-1.

- Step 7. Once the R_m, R_s, and R_t values have been determined for the applicable path through the relevance tree, the candidate programs can be evaluated. Program data sheets, as shown in the example for Tactical Global Positioning System Guidance (TGPSG) program (Figure E-1), will be grouped in the data package according to the subsystem levels. For example, the advanced development programs under the Guidance subsystem are:

  Tactical Global Positioning System Guidance

  Low-Cost Inertial Guidance System

  Radiometric Area Correlator

  Millimeter Wave Contrast Guidance

  Arm/Home-On-Jam for GBU-15 Data Link.

  These data sheets will contain the necessary data for the program evaluation. The program data sheets are reviewed to determine the proposed program impacts on the requirements of the applicable path of the relevance tree.

- Step 8. Using the appropriate appraisal criteria (Table B-1), the information contained on the program data sheets is evaluated for each program within the program group. The program data sheet prepared for the TGPSG program (Figure E-1), is

used to illustrate the evaluation. In this example, a review of the program data sheet reveals that the TGPSG, when used in conjunction with the Digital Integrating System and an inertial navigation system, will satisfy the all-weather guidance requirements. It can be employed worldwide, day or night, and will guide the weapon to the target with a high degree of accuracy. Further examination shows that it is an active guidance system, but will have high resistance to enemy jamming. A review of the schedule shows that the system will be available in the near-term. The criteria that applies is: "The task is essential to the subsystem and will not delay it," and the corresponding value of $R_a = 3$ is assigned to the program. The same process is then applied to each program within the program group. Rationale statements for the selected R_a-values are developed for each program under the Guidance subsystem. The rationale statements derived for the examples are shown in Figure D-1.

- Step 9. At this point, the data is organized into a manageable form and recorded for future use in the process. The organization of the data is described in detail in the second part of the example (Appraisal of a Selected Program). A format has been developed as shown in Figure F-1 to list all candidate programs under each applicable path of the relevance tree with R-values and rationale indices assigned to each of the relevance tree's elements. The rationale indices will reference the statements that are listed in the rationale section of the appraisal report, as shown in Table F-1. This format and rationale section forms the basis for the audit trail and lends itself to automation of the subsequent steps as the methodology matures.

- Step 10. After the R-value assignments are completed the product (raw score) of R_m, R_s, R_t, and R_a are normalized by the technique presented in the previous section and as described later. The results of the normalization process for the example are listed in Table 4.

TABLE 4. RESULTS OF THE NORMALIZATION PROCESS

PROGRAM	R_m	R_s	R_t	R_a	RAW SCORE	NORMALIZED R_1-VALUE
Tactical Global Positioning System Guidance	3	2	3	3	54	3
Low Cost Inertial Guidance System	3	2	3	3	54	3
Radiometric Area Correlator	3	2	3	2	36	2
Millimeter Wave Constrast Guidance	3	2	3	2	36	2
Arm/Home-On-Jam for GBU-15 Data Link	3	2	3	3	54	3

- Step 11. Evaluations are made for the Return-on-Investment parameter. In determining the R_2-value for Return-on-Investment, data sheets for this evaluation will be provided in the data package for each program. The data sheets are to be used as an aid in the mental integration process previously described. A Return-on-Investment Evaluation Worksheet for the TGPSG program (Figure E-2) was developed as an example. Applying the criteria of Table B-2 to the example worksheet results in the evaluation recorded in Table D-2. These judgements were based on the following factors: 1) cost is likely to grow because of the complexity of the test program; 2) schedule is dependent upon successful completion of several concurrent development programs which contribute to the likelihood of a delay; and 3) the TGPSG program depends upon parallel developmental efforts and the TGPSG anti-jam characteristics are uncertain. For each of these factors a rating of 2 was given. The Growth Potential is considered major; thus a rating of 3 is given since the TGPSG has the potential to be used for most long range tactical guided weapons. The category of Other Applications for the TGPSG program is considered broad because of its potential for U.S. Army, U.S. Navy, U.S. Coast Guard, NASA, and commercial applications ranging from transport aircraft to space systems; thus, a rating of 3 was given. The

evaluation for Return on Investment is made for each program within the program group. The representative R_2-value is determined simply by the largest number of specific R_2-values. In the example, $R_2 = 2$ appears more often than the other values. In the event of a tie, the lower value would be selected as the representative R_2-value. After the R_2-value is determined, the rationale is established and documented.

- Step 12. The determination of R_3, Uniqueness, is straightforward. Simply, the sources of availability are determined using the criterion of Table B-3. The source of availability is the rationale and is recorded with the corresponding R_3-value.

- Step 13. The ranking of each candidate program is determined by:

$$\text{Rank} = 3R_1 + 2R_2 + R_3$$

The coefficients are weighting factors which may change as the methodology is refined. For purposes of illustration, it is assumed that an evaluation of ROI and Uniqueness produced the results in Table 5.

TABLE 5. ASSUMED R-VALUES FOR ROI AND UNIQUENESS PARAMETERS

PROGRAM	ROI (R_2)	UNIQUENESS (R_3)
Low Cost Inertial Guidance System	3	3
Radiometric Area Correlator	2	1
Millimeter Wave Contrast Guidance	2	1
Arm/Home-On-Jam Data Link for GBU-15	1	3
Tactical Global Positioning System Guidance	2	3

The results of this example appraisal are contained in Table G-1, which shows the format to be used for the Candidate Program Listings. The R_1, R_2, and R_3 values and program ranking values are listed with the respective programs. Categories of A, B, and C are determined for the candidate programs based on the spread of the rank values. The candidate programs of Category A are considered the priority programs to be pursued, while those in Category C are deemed the least important. The category divisions are based on the Planning Panel's judgement, experience, and expertise. Separate program listings will be made for the Advanced and Exploratory Development Programs.

3. APPRAISAL OF A SELECTED PROGRAM

We have chosen the Tactical Global Positioning System Guidance (TGPSG) task to be used in this application of the Appraisal Methodology. As shown in Figure D-1 there is a family of tasks that relate to a relevance tree path. For this example, one program is evaluated for each applicable relevance tree path. Different approaches were used in the two examples; however, the end results of the appraisal would be the same. Although attempts were made to make the example R-values and rationale realistic, they are not representative of the projected appraisal results for the selected program. We believe that the implementation of the methodology as described in this example will be an invaluable aid in the appraisal process when the methodology is exercised for the first time. As the methodology is refined, some of the steps shown in the example will be computerized thus eliminating some of the forms necessitated by the manual data reduction process. The example was designed to facilitate the transition from the manual to the computerized process.

Figure H-1 contains the previously described relevance tree with its Level 6 element expanded to aid the planning group in the appraisal. As previously discussed, each level of elements belongs to a certain category:

- Level 0. Air Force Goals
- Level 1. Air Warfare Missions
- Level 2. Development Stimuli

- Level 3. Operational Missions
- Level 4. Mission Functions
- Level 5. Generic Weapons
- Level 6. Subsystems.

As can be seen from Figure H-1, the Level 6 elements are grouped horizontally by function (i.e., damage mechanisms, initiators, etc.).

To provide an audit trail and to facilitate computerization of the relevance tree elements, a code has been developed and is included in each of the elements below Level 2. The code chosen in Figure H-2 can be expanded at a later time, if necessary, to include the upper levels of the relevance tree. The first digit represents the operational mission; the second, the mission function; the third, the generic weapon; and the fourth, the subsystem. The letters x and a represent exploratory development and advanced development, and the latter two digits represent the candidate program. Using the codes, a computerized printout can be generated to show the candiate program relationship to the upper levels of the relevance tree. The format for the printouts is discussed later.

This example of the rigorous appraisal is presented in four parts:

- The Appraisal
- Data Organization
- Computations
- Prioritization.

a. The Appraisal

Because of the large number of assessments that are to be made, the candidate programs should be divided into several categories and assigned to subpanels for evaluation. A convenient way to group the programs is shown at Level 6, the Subsystem Level, of the relevance tree (Figure H-1).

The subsystem elements, reading from left to right, are grouped according to functions. For example, the row of elements directly under level 5, Generic Weapons, can be categorized as Damage Mechanisms; the next row is a category of Initiators; the next, Delivery Mechanisms; and so on. The grouping of elements as discussed, will facilitate the selection of panel members for the various subpanels.

The data package will contain program data sheets, as shown in Figure E-1, to provide a baseline and a starting point for the appraisal. The Mission Function requirements are in Appendix C and in Table C-1 and are the Weapon System Summaries from which Table C-2 was derived. The criteria to be used in assessing the candidate programs are shown in Appendix B. With the information provided in these figures and tables, the program assessment can begin.

The first and most difficult part of the appraisal process will be determining R_1-values for Need (R_1) and developing rationale supporting the R-values. The rationale for the R_1-values is derived by applying the appropriate criteria to the requirements, deficiencies, and anticipated capabilities of the proposed program as described in the previous example, Application of the Appraisal Algorithm. The R-values and supporting rationale are recorded on the Appraisal Worksheets provided in the data package. Examples of completed Appraisal Worksheets for the TGPSG program are shown in Figure D-2. After the Appraisal Worksheets are completed, the R-values for Return-on-Investment (R_2), Uniqueness (R_3), and the supporting rationale for these parameters will be developed as described in the previous example.

Once the subpanels have completed their appraisal of their assigned programs, each subpanel should brief its results to the Planning Panel. When the Appraisal Worksheets are approved by the Panel Chairman, they will be submitted as the official panel input to the Appraisal Report.

b. Data Organization

When the Appraisal Worksheets are approved, the data from the worksheets will be arranged as shown in Figure F-1. The computer generated format will list all tasks in exploratory and advanced development for each path of the relevance tree. A Rationale Section (Table F-1) which lists the rationale recorded on the Appraisal Worksheets will be referenced by rationale indices that are adjacent to the relevance tree descriptors and the corresponding

R-values as shown on the printout of Figure F-1. This type of presentation will show all the programs proposed to meet a requirement and the importance of each program when compared to its competitors. When the relative importance of one of the candidate programs is questionable, the supporting rationale can easily be found for examination and comparison to the rationale of its main competitors. Besides providing a concise listing of the candidate programs, the arrangement will form the base for the audit trail.

Figure F-2 contains an example printout for the TGPSG program for each applicable path of the relevance tree. In the appraisal report the printout will be expanded to include all other candidate programs supporting each relevance tree path.

c. Computations

As seen on the completed Appraisal Worksheets (Figure D-2), the product of R_m, R_s, R_t, and R_a is included at the bottom of the worksheet. These products (raw scores) must be normalized. The raw scores shown below represent all the possible products that can be formed for the range of R-values used. The raw scores on the Appraisal Worksheets are changed to their corresponding R_1-values.

RAW SCORE 81, 54	36, 27, 24, 18, 16, 12	9, 8, 6, 4, 3, 2, 1,0
R_1 VALUE 3	2	1

Up to this point, each candidate program has a quantity of R_1 values equal to the number of paths through the relevance tree. The method to reduce the multiple R_1 values to a single R-value to represent the program consists of two steps. The first step is to complete the Reduction Matrix. The normalized R_1 values from the Appraisal Worksheets are entered into the matrix at the respective intersections of Missions and Mission Functions. The program code and raw scores are also listed for convenience and traceability. The matrix heading contains identifying information and a list of candidate programs which are interrelated with the candidate program being considered. The example matrix shows the TGPSG program to be dependent upon the completion of the Digital Integrating System (DIS) and the Low-Cost Inertial Guidance (LCIG) programs before it can be integrated into a weapon system. The R-values of the

interrelated efforts must be reviewed as a group to ensure consistency of ratings, as explained later. The review of interrelating programs should occur during the panel review of the draft Appraisal Report. The second step in the R_1 reduction process is to determine the single, representative R_1 value for the candidate program. Referring to the Reduction Matrix (Table D-1) let N = sum of the entries in the matrix. In the example Reduction Matrix N = 11. The number of 3's, 2's, and 1's are then summed. If:

N = number of entries in the Reduction Matrix

A = number of 3's in the Reduction Matrix

B = number of 2's in the Reduction Matrix

C = number of 1's in the Reduction Matrix

then,

$\frac{A}{N}$ = relative measure of occurrence of 3

$\frac{B}{N}$ = relative measure of occurrence of 2

$\frac{C}{N}$ = relative measure of occurrence of 1.

For the TGPSG example:

$$\frac{A}{N} = \frac{9}{11} = 0.82$$

$$\frac{B}{N} = \frac{1}{11} = 0.09$$

$$\frac{C}{N} = \frac{1}{11} = 0.09.$$

From these ratios, it is seen that the R_1 value representative of the TPGSG program is unequivocally $R_1 = 3$. In cases where there is a tie, the lower R-value will be assigned. The panel will have the opportunity to make subjective adjustments of questionable appraisal results during the review of the draft Appraisal Report. During the review, the interrelated programs should be examined. For example, since the TGPSG program is dependent upon the completion of the Digital Integrating System (DIS) and the Low Cost Inertial Guidance System (LCIGS), these programs must be analyzed. If the programs are judged to be feasible, then they are also assigned an R_1-value of 3. If not, the R_1-value for the TGSPG program would be downgraded. In this example, it was determined that both DIS and LCIGS programs are feasible and as a result are assigned $R_1 = 3$ to correspond with the R_1-value for the TGPSG program.

d. Prioritization

The formula used for computing the rank values for the candidate programs is:

$$\text{Rank Value} = 3R_1 + 2R_2 + R3$$

The coefficients are weighting factors that may be modified as the methodology is refined. In this case, the Need (R_1) parameter has the greatest weight to prevent the Need from being overrun by the Return-on-Investment (R_2) and Uniqueness (R_3) parameters. However, the slight separation of the R_1 and R_2 weighting factors emphasizes the importance of budget considerations in the selection of programs. The least important of the three R-values represents Uniqueness. Once the rank values are computed, the candidate programs will be listed in decreasing order of importance. Figure G-1 shows the format for the candidate program priority listing. Separate priority lists will be developed for exploratory and advanced development programs. The format contains R_1, R_2, and R_3 and the computed rank value for each program as an aid for the review and reevaluation process. The candidate programs are then grouped into Categories A, B, or C to indicate the level of emphasis, with Level A being the highest.

SECTION VII

CONCLUSIONS AND RECOMMENDATIONS

The Program Planning and Appraisal Methodology developed for the AFATL promises to be a valuable tool for identifying candidate programs for both exploratory and advanced development. The proper evaluation of proposed programs allows the AFATL to provide a better response to the stimulus of documented operational, systems, and technology requirements. The basic use of the appraisal methodology will be as an appraisal aid to be employed in the AFATL planning process to:

- Ensure that there are no critical technology gaps between what is needed (from the planning and formulation of programs) and what is being done (from the current and proposed development program)
- Allocate available resources on the basis of assessment of the relative merit of proposed and ongoing exploratory and advanced development programs versus established appraisal criteria such as Need/Utility, Return-on-Investment, and Uniqueness of the work
- Identify and prioritize analytical deficiencies that prevent: 1) definition of the threat, 2) definition of requirements, and 3) definition of technological deficiencies.

The first example presented in the body of this report is reflective of the methodology being employed primarily to determine if all needs are being satisfied in a reasonable manner. The methodology is exercised in the second example to reflect how current programs can be assessed in terms of their response to a variety of needs.

Additional efforts required, as envisioned for implementation and continued exploitation of the appraisal methodology are:

- Formulation of an AFATL Program Planning Guidance document which is responsive to priorities and schedules as conceived by higher authority
- Formulation of programmatic data for use by evaluation panels
- Refine and enhance the existing appraisal methodology to all the synthesis and evaluations necessary to provide the quantified data that is reasonable to use in an appraisal process
- Identification or recognition of requirements for generic weapon systems which are needed to counter threats projected for the long-term
- Selection of specific advanced generic system concepts which will be subjected to trade-off analyses and optimization for both near- and long-term requirements
- Conduct system trade-off analyses for the specified advanced Generic Systems Concepts
- Develop technical strategies which will resolve existing technological gaps or deficiencies in the nonnuclear weapons area.

APPENDIX A

THE DOD PLANNING, PROGRAMMING, AND BUDGETING PROCESS

The DOD Planning, Programming, and Budgeting (PPB) System is the major process which exists for the purpose of helping the Secretary of Defense shape the Defense program and manage the Department. The PPB process is largely internal to DOD and helps focus the contributions of many DOD organizations on the problems of planning, obtaining, and maintaining U. S. military capability.

PPB Overview

The current PPB process contains three distinct phases: (1) Preparation of Planning Guidance, (2) Programming, and (3) Budgeting. The phases each have several major steps that build upon one another. About twenty-four months elapse between the time the JCS staff begins work on the strategy proposal and the President sends the DOD budget to the Congress. The cycle is a continuous process which requires major contributions from the Joint Chiefs, the Military Departments, the Defense Agencies, the Office of the Secretary of Defense (OSD) and of course, the Secretary himself.

Guidance Planning

Provides Secretarial policy, strategy, fiscal guidance and planning assumptions in response to which Military Departments and Defense Agencies prepare 5-year program proposals. Two major documents are issued by the Secretary:

- Defense Guidance (Policy and Strategy)
- Planning and Programming Guidance Memorandum (Planning and Programming) This contains:

  1. Force Planning Guidance
  2. Fiscal Guidance
  3. Material Support Planning Guidance

The Defense Guidance document provides overall policy and strategy guidance to the Military Departments, the JCS, and Operational Commanders which incorporates Presidential, JCS, and Secretarial views into one comprehensive statement for planning.

The PPGM provides detailed scenarios for force and materiel support planning and fiscal constraints within which all programming is to be accomplished.

Programming

The objective is to obtain, during the spring and summer a five-year Defense program, approved by the Secretary, which will serve as the basis for Military Department and Defense Agency budget proposals in the fall. The major outputs of this portion of the cycle are the Program Decision Memorandums (PDMs) which modify Military Department and Defense Agency 5-year program proposals (POMs).

Five-year program proposals are submitted by the Secretaries of the Military Departments and heads of the Defense Agencies, and must be prepared within the Secretary's financial constraints and planning guidance. They contain detailed costs as well as force, manpower, and procurement tables, and provide Military Department rationale for the proposed programs.

The POMs are reviewed for the Secretary by the OSD staff. Issue papers are prepared which focus on areas in which the POMs do not meet the Secretary's guidance or which propose implementing the guidance differently than expected. Alternatives are prepared for Secretarial decisions on these issues, which form the basis for the approved 5-year program.

Budgeting

The major purpose is to provide a DOD budget, for transmittal to the Congress, which is defensible and as lean as possible and which is consistent with Presidential Budget goals.

The Military Departments and Defense Agencies submit their budget proposals to the Secretary in October. Between that time and mid-December, the OSD and OMB staffs review the proposals and prepare a series of short decision papers for the Secretary (Program Budget Decisions). Once all decisions have been made, the Secretary and the Director of OMB meet with the President to obtain his final decisions on the Budget, which is then prepared for submission to Congress.

PLANNING
PROGRAMMING
BUDGETING
SYSTEM

HISTORICAL MILESTONES 1961-1973

DEPARTMENT OF DEFENSE

PLANNING-PROGRAMMING-BUDGETING SYSTEM

DOD PROGRAMMING SYSTEM - 1961 - 1973

I. BACKGROUND

To place the Planning-Programming-Budgeting System (PPBS) in proper perspective requires a quick glimpse into the past to identify first why an alternative procedure was necessary, and second, what was hoped to be gained by development of the new management system.

A. During the years prior to 1961, financial management and military planning seemed to be worlds apart since each had been treated as independent activities: the first, under the jurisdiction of the Comptroller, and the second under the dual jurisdiction of both the Joint Chiefs of Staff and the planning organizations of the Military Departments.

B. Planning by Military Departments and the Joint Chiefs of Staff was accomplished in terms of military forces and major weapon systems projected over a period of from five, ten or even twenty years. Conversely, budgeting was accomplished in terms of preorganized financial categories acceptable to Congress as representative of an approved budget submission format. Budgeting was projected, however, for only one year ahead.

C. It was quite apparent that planning and budgeting were on completely different wave lengths. Military plans were being prepared with little regard to resource constraints, and the costs of the developed plans were always far in excess of any budget the Administration could hope for or was willing to request from Congress. The product of the dual action was more of a piecing together of unilateral Service plans than that of a unified Department of Defense program. For the most part the order of priority of forces, weapon systems and activities was left to each Military Service. This took on the appearance of Service competition and it was not surprising, therefore, that serious imbalances had developed in the over-all Department of Defense plan.

D. Presentation of both the plan and the budget to the Secretary of Defense left him with no alternative but to cut back military programs each year as he performed the budget review. Expeditious choices and decisions on forces and weapon systems necessarily were made without adequate information as to total cost implications, cost effectiveness relationships in terms of missions they were designed to perform or without benefit of review of alternative plans. Decisions made under these circumstances, that had long-term resource implications, many times led to overcommitment. Later these decisions frequently resulted in uneconomical program "stretch-outs" or often outright cancellations on which large sums of money had already been invested.

E. The budget, on the other hand, while still necessary for the management of certain classes of Defense activities, i.e., military personnel, operations and maintenance, procurement, etc., did not focus on the key decision-making areas of principal concern to top management in the Department of Defense. For example, the budget did not allow an alternative choice of major weapon systems in relation to military tasks and missions. It could not produce the data or information needed to relate costs of weapons to their military effectiveness, nor did it disclose the full time spectrum of proposed programs since its own time horizon was generally limited to one year.

F. Technological advances, military streamlining and the sophistication of weapon systems all played a major role in the turn of events leading up to the introduction of the PPBS. There had long been a leaning in the Department of Defense to state our military requirements in absolute terms without reference to the eventual cost. We have since learned that the effectiveness or military worth of any given weapon system or force unit cannot logically be considered in isolation without dire consequences. Such weapons or forces must be considered in relation to costs, and, where there are financial restraints, to the alternatives to which the approved resources may be put. Or, to put it another way, military requirements are meaningful only in terms of benefits to be gained in direct relation to their cost. Therefore, we also learned that resource costs and military worth are inseparable from the viewpoint of sound management.

G. Notwithstanding the weakness already mentioned, there was a persistent area that may have been the most critical weakness of the pre-PPBS operation. This was its inability to provide, on a systematic basis, sound cost data on the individual weapon systems and force units for any period beyond the budget year. Without this kind of information, decision makers were without basis for judging the relative costs and military effectiveness of alternative programs. This information was particularly acute in instances where major weapon systems conception, development, procurement and final deployment, demanded long lead-time consideration and time-phased cost projections. Coupled with this weakness was the lack of a systematic way to inform top management of the current status of the entire Department of Defense program in order that corrective action could be taken in a timely manner when and if required.

The above paragraphs suffice to outline the apparent weakness of the pre-PPBS operation and, therefore, identify the "why" requirement for a new system.

The "what" that was hoped for was the preservation of stability of the decision-making process by providing a bridge between the existing "planning" and "budgeting" independent systems and thereby closing the circuit by the identification of a unified Department of Defense system.

II. SYSTEM DEVELOPMENT

A. It likewise seems appropriate to provide a sketch of the beginning of the DoD Programming System in 1961 before presenting a resume of its historical changes.

B. When Mr. Robert S. McNamara became the Secretary of Defense in January 1961, Mr. Charles J. Hitch became his Comptroller. Mr. Hitch was immediately confronted with the monumental task of directing the financial management effort of the biggest business in the world. He did not come unprepared. Under auspices of the Rand Corporation, he developed some detailed thoughts on the subject of financial management in the Department of Defense and had articulated these ideas in a book called "The Economics of Defense in the Nuclear Age." (1.) The Comptroller suggested to the Secretary of

Defense that he would like to put his ideas into operation for a trial period and, if they proved successful, extend them later to a fully operational status. The Secretary was so convinced regarding the efficacy of the ideas, he directed that a revised financial management system be implemented in time to be used in the budget formulation process in the fall of 1963. Through the outstanding support of the Military Departments, a programming system was developed in approximately six months.

C. The basic concept of the programming system is to bridge the multi-year military planning system and the one-year budget system. This is accomplished through systematic approval procedures that "cost out" force requirements for financial and manpower resources five years into the future, while at the same time displaying forces for an additional three years. This gives the Secretary of Defense, the Congress, and the President an idea of the impact present day decisions have on the future defense posture.

D. In the two years following the introduction of the DoD Programming System, many modifications and refinements were made. A computerized data base was established, new reports were added, and other reports were modified or deleted. These two years were considered a necessary adjustment period, with the Military Departments in some cases modifying their management systems to accommodate to the DoD Programming System, and in other instances the Programming System was changed to agree with existing management systems.

III. SUBSEQUENT DEVELOPMENTS

1 9 6 3

A. Calendar Memorandum

In December 1963, the Secretary of Defense distributed a memorandum in which he outlined some changes that would be instituted in 1964. (2.) During the first two years of operation of the Programming System, the DoD Components submitted force change proposals to the Secretary without

benefit of his tentative guidance. The December memorandum explained how this would be changed for the calendar year 1964 planning cycle.

B. TFG/JSOP

Forwarded with the Secretary's memorandum was the currently approved defense program force tables marked up to reflect quantitative changes, with a narrative explanation of the rationale behind the changes. These documents became known as the TFGs or Tentative Force Guidance documents. The Joint Chiefs of Staff then submitted proposed new force tables highlighting any additional changes requested and supporting these proposals with a narrative description of the military objectives in question and a quantitative analysis of how the proposed changes would affect the ability to achieve these objectives. This document is known as the Joint Strategic Objectives Plan (JSOP).

C. Cost/Manpower Requirements

The Secretary's memorandum also requested that military departments submit cost and manpower requirements associated with the proposed new force tables being included in the JSOP. This procedure was designed to provide a basis for a broad program review of forces rather than a review of individual force proposals. Review of the proposals by OSD was to be completed within 30 days and the force changes again published with a narrative explaining the Secretary's rationale for the revision.

D. Other Proposals

The Secretary requested that JCS and the Military Departments submit their comments on the tentative decisions, together with any rebuttal statements and any proposals that had an effect on the FY 1966 budget, whether they were force related or not. His intentions were to have all program decisions completed by late August so that the DoD Components would have adequate time to prepare their FY 1966 budget submissions.

1964

A. Directive Publication

The next significant step in the evolution of the programming system was the publication of DoD Directive 7045.1, titled "DoD Programming System." (3.) The following quotation from the Directive is indicative of the prominence and stature that the programming system had achieved by this time.

> "The Five-Year Force Structure and Financial Program (FYFS&FP) is the official program for the Department of Defense . . . The planning, programming, resource, materiel and financial management system of all DoD Components will be correlated with the programming systems set forth herein."

It also seems appropriate to quote three definitions from the same Directive to better understand the language of the programming system:

> "Program Element - an integrated activity; an identifiable military capability; a force, support activity, research activity, etc., comprising a combination of men, equipment, and facilities."
>
> "Programs - a combination of program elements designed for the accomplishment of a definite objective or plan which is specific as to the time-phasing of what is to be done and the means proposed for its accomplishment The major components of the DoD Programming System are the numbered programs in the FYFS&FP."
>
> "The Five-Year Force Structure and Financial Program (FYFS&FP) - the summation of the approved programs of the DoD Components."

These definitions provide the concepts for the structure of the programming system. The program elements are the basic decision points; similar or homogeneous program elements make up a program; the sum of the programs equals the defense posture.

B. Program (Functional) Reviews

During the year provisions were also made for a series of comprehensive program reviews which included functional areas comprising aggregations of interrelated program elements. The areas scheduled for review were Consolidated Intelligence, Cryptologic Intelligence, National Military Command System, Medical Services, Supply and Procurement Operations, Transportation, and Command, Control and Communications; only the Intelligence, Cryptological, Medical and Command, Control and Communications were actually conducted, however. The objective was to provide an in-depth examination of the respective areas for the adequacy and effectiveness of the resources assigned relative to support they provided to the overall missions and objectives of the Department of Defense. Reviews included all interested DoD Components. The culmination of the review was a recommendation to the Secretary of Defense for changes to the approved program.

C. Non-Add Elements

Changes were also made to the program structure this year. One change resulted in the addition of a series of "non-add" program elements. The purpose of the "non-add" or memorandum-type elements was to provide visibility for the support that Military Departments were supplying to Defense Agencies. Resources in these non-add elements were represented twice in the program structure, once as an integral part of a primary element wherein its purpose was not discernible, and again for discrete visibility in the non-add elements.

D. Army Structure Change

Another change was a major revision to the Army program elements in the General Purpose Forces program. A study of the program structure had indicated that a different presentation of the Army's forces would be more meaningful for the Army as well as for the OSD analysts.

E. Cost Effectiveness

1. Another step taken which did not have an immediate effect on the programming system, but

was designed to play an important role in the future, was the publication of DoD Directive 7041.1, "Cost and Economic Information Systems." (4.) This Directive introduced cost effectiveness studies into the programming system.

2. The purpose of cost effectiveness is to examine various alternative weapon systems with the objective of maximizing utility for a given level of cost or to minimize cost for a given level of utility. It is readily apparent that a sound data base of unit cost information is essential to these studies. The Directive (7041.1) was promulgated in order to:

> ". . .provide to the Military Departments, Defense Agencies and the Office of the Secretary of Defense comparable, reliable, and timely cost and economic data on weapon systems, major items of equipment . . . to:
>
> "1. Improve cost estimating, cost and price analysis and progress reporting, and
>
> "2. Enhance the effectiveness of planning, programming, budgeting, contract negotiating, and program or project management . . ."

3. This was one of the early steps taken to provide a better cost data base for future cost effectiveness studies.

1 9 6 5

A. Publication of Instructions

1. The culmination of much coordinated effort during 1964 came early in 1965 with the publication of three Department of Defense Instructions. The first, DoDI 7045.2 (5.), provided specific procedural guidance for the preparation, submission, review, evaluation and resolution of Program Change Proposals. In order to assure uniformity in submission of proposals from various DoD Components, detailed forms and instructions were provided.

2. The second, DoDI 7045.3 (6.), provided specific procedural guidance for preparation and submission of program element summary and descriptive data sheets to reflect approved programs or approval of program changes. The purpose of these reports was to provide a repository of information relative to various program elements as well as the significant weapon systems and major items of equipment.

3. The third, DoDI 7045.4 (7.), provided specific procedural guidance for submission of program change data in machine readable form. As sophistication was built into the programming system, greater amounts of detail were provided and new and better ways for processing these data became obvious.

B. Planning Versus Operational Use

The defense posture represented in the FYFS&FP was, by design, a peacetime representation. It was designed principally as a planning document and not as an operational document. Events of 1965 were to test whether the data could be modified to reflect an operational environment. The Dominican Republic incident, as well as the buildup of forces in Vietnam, caused some procedural changes. Normally, all decisions made by the Secretary are within the framework of the programming system. The abnormal conditions gendered by the Vietnam buildup and the Dominican Republic incident caused the Secretary to make some decisions outside the programming system procedures. These decisions were, nevertheless, reflected in the FYFS&FP on an ex post facto basis.

C. Presidential Announcement

During 1965, the momentum of the Planning-Programming-Budgeting System had attracted the attention of a number of industrial organizations and other executive agencies within the Government. In August, President Johnson, on a nation-wide TV broadcast, stated that his confidence in the system was such that he had directed the same basic principles of the PPB concept be adopted by most of the other executive branches of the Government, to be installed no later than February 1966.

D. Comptroller Change

In September, Mr. Robert N. Anthony was appointed as the Assistant Secretary of Defense (Comptroller). Like Mr. Hitch, Mr. Anthony was familiar with the operation of the Department of Defense having done consulting work on management accounting and control problems for the Navy and Air Force, and the Office of the Secretary of Defense.

E. Consultant Firm Study

An early action taken by Mr. Anthony was to have a management consultant firm look at the decision-making processes in the Department of Defense, as it was embodied in the programming system. Another of his early actions was to focus management improvement efforts on Resource Management Systems. More on these efforts in the balance of this paper.

F. OSD Organizational Change

A significant change to take place during 1965 was an OSD organizational change whereby the system analysis functions were divorced from Comptroller and established under a new office, known as Assistant Secretary of Defense (Systems Analysis). The separation of systems analysis led to the introduction of the Draft Presidential Memoranda (DPM) and Defense Guidance Memoranda (DGM), both of which became identified as tentative guidance documents necessary in the initial phase of the calendar cycle.

1 9 6 6

A. Calendar Memorandum

1. In March, the Secretary again issued the annual calendar memorandum (8.). This memorandum changed the name of the FYFS&FP to the Five Year Defense Program (FYDP), and included several changes to the decision-making process. The main thrust of these changes was to:

a. Differentiate in the planning and programming efforts between "major force-oriented issues" and "other decisions," and

b. Provide for an early identification and timely resolution of major force-oriented issues.

2. Major force-oriented issues were defined as those issues concerning proposals, required to be resolved during the current budget year and which, if approved, would have a major effect on military forces. Procedures for resolution of these issues were briefly as follows:

a. The Secretary would issue a tentative list of major issues early in March.

b. By mid-March, DoD Components were required to submit any additional items for inclusion to the list.

c. By end March, the Secretary issued an approved revised list. (As necessary, the list could be modified throughout the year.)

d. In April, the list was transmitted to DoD Components and included responsibility of assignments and suspense dates.

e. In early August, after consideration of the JSOP recommendations, the Secretary issued draft Memoranda for the President containing tentative recommendations on all major force-oriented issues for review and discussion by DoD Components.

f. Comments from DoD Components were required within 30 days.

g. In early October, after consideration of comments received, the Secretary would then issue revised memoranda announcing his decisions.

h. Upon receipt of the revised memoranda, the DoD Components prepared detailed documents to align the Five Year Defense Program with the decisions made. Upon approval of the documents by the ASD (Comptroller), they were then incorporated into the approved FYDP.

B. Interim Operating Procedures (IOPs)

The Comptroller issued a series of interim operating procedures providing the detailed procedures necessary to implement the guidance promulgated in the memoranda mentioned above. These procedures were influenced by the results of the previously mentioned management study conducted by the consultant firm.

C. Major Force Issues

One such procedure dealt with major force-oriented issues (9.). It explained in detail how the issues were identified, discussed, resolved, and implemented. The second procedure described the form, content and processing procedures for Program Change Requests (PCRs) and Program Change Decisions (PCDs). (10.) The PCR provided detailed resource requirements necessary to change the FYDP. The PCD announced the decision.

D. Updating the FYDP

The third procedure provided the means by which PCDs were incorporated into machine readable data used to update the automated FYDP base file. (11.) The fourth procedure established criteria under which FYDP codes, titles, and definitions were to be established, cancelled, or changed. (12.)

E. Lack of Control

The Comptroller recognized that there were some management control features which had not been built into the programming system due to the constraints of time and manpower resources. A most important step was to make the accounting operations consistent with the planning-programming-budgeting system.

F. Cost Effectiveness Techniques

An important facet of the programming system is the use of cost effectiveness techniques. A necessary ingredient in cost analysis is a solid foundation of unit cost data, and it was felt that the best way to establish this foundation was to anchor it in an accounting system that was part of the total PPBS effort.

G. Operating Expense Accounting

The facet of accounting that needed the most attention was in the operating expense area. Although operating expenses involved more than one-half of the Defense budget, there was no acceptable way to trace whether operations dollars were being spent for the same prupose as the programming and budgeting systems had specified. To correct this deficiency, a common chart of accounts was established that could be used to trace the flow of the operating dollar from the programming stage, through the budget process, and finally through expenditure.

H. Program Structure Changes

1. The major impact of the changes made during this period was an extensive revision to the program structure. The purpose was fourfold: (a) It was necessary to restructure the program giving visibility to both independent and dependent programs within the structure. For independent programs, it is possible for managers to make independent decisions or recommendations in the sense that the size and make-up of the program is predicated on the demands of the military posture and the dictates of the world situation. Conversely, the dependent programs are generally dependent on the size and character of the independent programs. (b) It was necessary to reorient the program elements within the structure so that, where possible, they would correspond to financial responsibility centers. This was necessary because although the planning and programming was done in terms of program elements, operations were carried out by

responsibility centers. (c) It was necessary to provide discrete visibility to the various support areas. (d) It was necessary to provide more uniform program element definitions.

2. The first three areas were undertaken early in 1966 with the publication of a "straw man" or "first cut" of a revised program structure, which was sent to all DoD Components for comments. The effort in this direction was completed in August with the Publication of a new program structure, with a definition for each element. The system would operate with this structure and definitions, and would be revised based on use. More about this project in 1967.

I. PMS Directive Issuance

Also in August, DoD Directive 7000.1 was issued to establish objectives and basic policies for improvement of Department of Defense resource management systems. (13.) The significance of this Directive relative to the programming system is reflected in a quotation from the Directive, as follows:

> "Department of Defense approved plans will be stated in the Five Year Defense Program. This program will be the nucleus of Department of Defense resource management systems; and planning, programming, budgeting, accounting and reporting for the Department of Defense will be consistent with it."

J. FYDP Subsystems

Late in 1966, the first steps were taken to investigate the feasibility of subsystems to the FYDP. It was anticipated that subsystems would include more detail than the parent system but be relatable to it. This project was well established by June 1968 when the DoD Instruction was published which identified the first subsystem as "Operations."

1 9 6 7

A. Calendar Memorandum

As in past years, the Secretary of Defense issued the annual calendar memorandum (14.) again calling attention to the necessity of focusing on the identification and resolution of major force issues. All DoD Components were requested to submit a recommended list of major force issues which required resolution during 1967. The Secretary indicated that an approved list would be issued by late January based on the DoD Components' submission of issues. A change from prior calendar memoranda was the provision for staggered submission of Program/Budget reviews to relieve the peakload burden of the October-December time period.

B. List of DPMs

In May a revision to the calendar memorandum was issued (15.) which provided that a list of Draft Presidential Memoranda would be issued in early June to include title, topics to be covered, and the date on which they would be published. The DoD Components were asked to respond to these memoranda by the submission of narrative comments as well as Program Change Requests (PCRs). For those issues not addressed in a DPM, PCRs were to be submitted by mid-July, to be acted on by OSD by mid-August. The concept of staggered budget submissions was modified to include only the Military Construction program as an early submission.

C. Publication of Handbook

During May a refinement of the program element definition was sent to DoD Components for their review. This resulted in the publication in August of the FYDP Codes and Definitions Handbook (7045.7-H).

D. Publication of Instruction

In December, another Instruction of the programming system was published, 7045.7 (16.), which superseded and caused to be cancelled DoD Directive

7045.1 and Interim Operating Procedures 1, 2 and 4. While largely including provisions of the aforementioned procedures, it provided one major change. Previous Instructions provided a certain amount of program flexibility to be embodied in the authority of the heads of the DoD Components, primarily in the area of dollar adjustments in program years beyond the budget year. The new Instruction expanded that authority to a considerable extent, by giving heads of DoD Components authority to make any adjustments between programs or program elements in years beyond the budget year so long as they did not increase the total of any of the three cost categories, i.e., development, investment, and operating costs, for the Component. This was accomplished to facilitate the development of a balanced program without the need for a PCR.

1 9 6 8

A. Annual Calendar Memorandum

In February, the Secretary, as in past years, issued the annual calendar memorandum outlining the significant actions to be taken for calendar year 1968. (17.) Except for the concept of the early identification and publication of major force issues being dropped, no significant modifications to the programming cycle were included in this memorandum.

B. Elimination of MFOI Identification/Procedures

The initiating document was the Joint Strategic Objectives Plan to be submitted by the Joint Chiefs of Staff to the Secretary in March. This document was to include the major issues thereby negating the need to identify these issues separately in advance of its publication. This was to be followed in April by a schedule of issue dates for specific Draft Presidential and Defense Guidance Memoranda. The first comment memoranda would be published in May. Within 30 calendar days, the DoD Components were to respond with narrative comments and PCRs that detailed resources needed to implement the changes discussed. DoD Components were encouraged to express alternate

proposals by submission of additional PCRs. After an analysis of the narratives and the PCR, a second series of memoranda called "Tentative Record of Decision," would be issued. These would be immediately followed by the OSD issuance of PCDs in the detail necessary to update the FYDP.

C. Early Program Submissions

The memorandum also requested the DoD Components to submit new proposed Military Construction projects for FY 1970 and Military Family Housing Programs for the fiscal years 1970 through 1974 by early August.

D. Publication of Update Instructions

In May, DoD Instruction 7045.8 was published (18.) which superseded and caused Interim Operating Procedure No. 3 to be cancelled. This Instruction provided the procedural and technical guidance for the machine readable submission of program element change data needed to update the OSD FYDP data base. Changes from preceding procedures encompassed the manner of coding input data and simplifying submissions.

E. Instructions for Use of FYDP Subsystems

1. In June, DoD Instruction 7000.5 was published. (19.) The Instruction evolved from efforts initiated in 1966 for the identification and implementation of subsystems to the FYDP. This is the first of a series of data systems to be designed to meet detailed information needs of the OSD.

2. The Instruction was designed to prescribe reporting requirements for data flowing out of various accounting instructions pertaining to operations costs. The first stage of implementation covers basic accounting instructions requiring that gross expense data be maintained by program element, functional category and expense element. Basic accounting instructions are DoDI 7220.20 (20.), and DoDI 7220.22 (21.). The subsequent implementation phases of DoDI of the 7000

series will include data from other cost accounting systems such as Central Supply/ Maintenance, Hospitals, Property Disposal, Depot Maintenance, etc. All data flowing through the Operations Subsystem will be relatable and/or reconcilable to summary data in the FYDP.

3. The Instruction provides a new concept in data information handling and reporting.

F. Modification of Programming Procedures

In mid-June, a memorandum signed by the Deputy Secretary of Defense was distributed that modified the programming procedures for the remainder of the calendar year (22.). The important change in this memorandum was the new role of the Record of Decision Draft Presidential and Defense Guidance Memoranda. Up to this time, the procedure had been, briefly: "Comments" DPM/DGM would be distributed to the various DoD Components; they were to provide their comments and also PCRs that would "price out" the indicated changes; OSD would evaluate these documents and then provide a Record of Decision DPM/DGM, which would be followed in a few days by PCDs. The new procedure reverses the sequence of the Record of Decision DPM/DGM and the PCDs. Now the PCRs, due in the OSD 30 days after the comment DPM/DGM, will be responded to in 10 days by PCDs. The Record of Decision DPM/DGM will be prepared in the period November-December, and will serve to summarize or "wrap up" both the PCDs that have been issued and also the budget decisions that have been made. The change will speed up the PCD process so as to have all major program decisions made prior to the annual budget cycle. Additionally, the Record of Decision DPM/DGMs will provide a stronger bridge between the programming system and the budgeting system by summarizing and coordinating the decisions in one document.

G. Comptroller Change

In July, Mr. Robert C. Moot was appointed as the Assistant Secretary of Defense (Comptroller). Like his predecessors, Mr. Hitch and Mr. Anthony, the operation of the Department of Defense was quite familiar to him. Mr. Moot had directed

the Small Business Administration prior to his appointment as the Assistant Secretary of Defense (Comptroller); however, he had been associated with the Department of Defense in Installations and Logistics for many years.

H. Isolating the Problem

An early action taken by Mr. Moot was to stimulate an exchange of ideas on how to improve the OSD and Component working relations throughout the PPB system. This was accomplished by open discussions during his weekly Financial Management meetings attended by each of the Military Department Financial Managers. Unlike Mr. Anthony who had an outside consultant firm look at the DoD decision-making process, Mr. Moot decided that the system should be critically examined by those within the Department of Defense. He called on the Financial Managers to isolate the problems that they might be studied.

I. PPBS Improvement Committee

The volume of proposals submitted for the improvement of the PPB system by the DoD Components was so impressive that in a memorandum (23.) issued by Mr. Moot on September 28, 1968, he advocated the forming of a Department of Defense group to provide an in-depth analysis of each proposal. The PPBS Improvement Committee was formed and consisted of members from each of the Military Departments, the Joint Chiefs of Staff, and each of the Assistant Secretary of Defense offices that had an interest in the proposals under study. The memorandum suggested to the Financial Managers that a period of five to six weeks be used to fully review their own internal procedures.

J. No Change to Current Procedures

It was recommended that no change, beyond that outlined by the Deputy Secretary of Defense in his June 15 memorandum (22.), would be made for the remainder of the 1968 calendar year.

1 9 6 9

A. Secretary of Defense Change

In January, Mr. Melvin Laird and Mr. David Packard were appointed as Secretary of Defense and Deputy Secretary of Defense, respectively, vice Mr. Clark Clifford and Mr. Paul H. Nitze.

B. PPBS Improvement Committee Meeting

In February, the first meeting of the full PPBS Improvement Committee was called by the Chairman. At the meeting a subcommittee was formed to be known as the PPBS Improvement Working Group to be under the Chairmanship of Comptroller, specifically the DASD(MSD). This Group was eventually responsible for the formulation of the existing PPB system.

C. Calendar Memorandum

In March, the Deputy Secretary of Defense signed the annual calendar memorandum (24.). This memorandum remained much the same as the CY 1968 schedule with the exception that all the OSD decision documents were not clearly identified and, therefore, the calendar scheduled was revised and reissued again on April 22 (25.). The revised calendar schedule was signed by Mr. Laird and, as stated in the memorandum of transmittal: "I consider CY 1969 to be a year of transition." He also recognized that the revision introduced several changes to the PPBS. Mr. Laird also stated that he expected further improvements in the system to be implemented by CY 1970.

D. Arlie House Conference

In May, the Secretary of Defense convened a DoD Management Conference at the "Arlie House" in Warrenton, Virginia. This conference included the Deputy Secretary of Defense, the Chairman of the Joint Chiefs of Staff, the military chiefs and civilian Secretaries of the Military Departments, the Assistant Secretaries of Defense, and selected individuals. The subject of the DoD decision-making process and the improvements in the PPBS were high on the agenda at that conference which continued for three days.

E. Isolation of Areas for Study

The exchange of ideas both in writing and in open discussion between Mr. Packard, the Joint Chiefs, and the Service Secretaries resulted in the isolation of key points that were candidate for further study towards the improvement of the PPBS concept. These areas were outlined in June and turned over to the PPBS Improvement Committee.

F. Alterna[illegible] Proposals

The PPBS Improvement Committee developed two proposals which described major events in the PPBS cycle. Mr. Laird transmitted these proposals to the Secretaries of the Military Departments and the Chairman of the Joint Chiefs of Staff for their review and consideration of the dates on which the major events were scheduled to take place. Mr. Laird requested a meeting on July 3 to further discuss the merits of the alternative proposals.

G. Laird/Packard Nine-Point Program

The culmination of efforts which started at the "Arlie House" conference became known as the Laird/Packard nine-point program. This was transmitted to the DoD Components on July 7 with the announcement that the task of preparing a detailed procedure encompassing the nine points would be taken over by the PPBS Improvement Working Group and was tentatively scheduled for August 1.

H. PPBS Improvement Working Group

Although the PPBS Improvement Working Group had been in session for four hours a day, three days a week, since March 3, their immediate concentration was on providing necessary instructions and procedural guidelines for the on-going schedule which was changed by the April 22 memorandum (25.). This effort resulted in an Interim Operating Procedure (IOP) #1 issued on June 21, which outlined the policy and procedures for the remainder of the CY 1969 cycle (26.).

I. New Instruction

On October 29, the PPBS Improvement Working Group obtained final coordination and signature on a new DoD Instruction 7045.7, "The Planning, Programming and Budgeting System" (27.). The Instruction included the nine basic points of the Laird/Packard concept which simply stated are:

1. Emphasis on early issuance of JSOP, Vclume I, Stragegy.
2. The issuance of Secretary of Defense Strategy Guidance.
3. The issuance of Secretary of Defense Fiscal Guidance (Tentative).
4. The transmittal of JSOP, Volume II.
5. Transmittal of final Fiscal Guidance.
6. Issuance of Joint Force Memorandum by JCS.
7. Issuance of Program Objectives Memorandums (POMs) by the DoD Components.
8. Issuance of Secretary of Defense Program Decision Memorandums (PDMs).
9. Submission of Budget Estimates by the DoD Components.

J. Calendar Memorandum

In November, the Secretary of Defense signed and issued the Calendar Memorandum for CY 1970 (28.). The early issuance was based on the publication of the new DoD Instruction 7045.7 and included all the significant points of the Laird/Packard concept. The early publication of the planning schedule allowed more time to concentrate on the preparation of the significant new actions, most of which were not clearly defined due to the newness of the concept. The new CY 1970 schedule redefined most of the input and output documents including the introduction of the issuance of the Fiscal Guidance and the input by the JCS of the Joint Force Memorandum.

1 9 7 0

A. Need for Extension of Time

Several DoD Components had expressed the need for additional time in which to prepare their comments on the Tentative Fiscal Guidance. In a February memorandum (29.) to all Components, the Deputy Secretary of Defense issued new response dates different from those expressed by the schedule issued in November to provide sufficient response time. This action also changed the date of issuance of both the final Fiscal Guidance and the Joint Force Memorandum input date. The input date for the POMs was to remain unchanged. Subsequently, by separate memorandum in May, the Deputy Secretary permitted a new input date for POMs from May 15 to May 22.

B. Revised CY 1970 Schedule

In May, the Deputy of Defense issued a memorandum (30.) revising the calendar schedule to specifically cover those significant actions to take place through September. This memorandum outlined the proposed Program Decision Memorandums (PDMs) that would be issued on August 10. Those identified were Strategic, General Purpose Forces (including sections on (1) Theatre, Nuclear, Land, Naval, Tactical Air and Mobility Forces, (2) Production Base Support, and (3) Support to Other Nations), Research and Development, General Support and Manpower (including General Support, Communications, Family Housing and Homeowners' Programs, and Military Construction), and Intelligence and Security. The major issues involved in each of these decisions were to be discussed with the appropriate Component, Mr. Laird and Mr. Packard.

C. Additional Alternative Programs

In June, the Deputy Secretary of Defense in a memorandum (31.) requested each of the Military Departments to submit alternative programs that may be used in presenting the DoD force structure to the National Security Council and the Defense Program Review Committee. In anticipation of the NSC calling for revised DoD budgets, the Secretary's memorandum suggested the alternatives and requested specific views on these by June 26.

D. Revised Fiscal Guidance

In August, the Secretary of Defense signed a memorandum (32.) to all DoD Components which revised the FY 1971 and CY 1972 Budget Estimates Fiscal Guidance pending the issuance of Program Decision Memorandums. This permitted the FY 1972 estimated budget submissions to be based on the March 24 Fiscal Guidance totals for each Defense Component and the "Service Preferred" POM program.

1 9 7 1

A. Calendar Memorandum

In January the Deputy Secretary of Defense, Mr. D. Packard, signed and issued the annual Calendar Memorandum (33.). This memorandum provided a substantive change from the previous schedule in terms of document definition and transmittal. Such documents as the Fiscal and Force Capability Guidance were introduced and the schedule called for the transmittal of a DoD Analysis of Strategies, Capabilities and Costs to the DPRC/NSC. Also this schedule called for providing a memorandum to both NSC and OMB summarizing forces and capabilities used as a planning base for the FY 1973 budget. The budget schedule remained much the same as in previous schedules.

B. Planning and Programming Documents

Early in February in accordance with the calendar schedule, the Tentative Fiscal Guidance (34.) was issued by the Deputy Secretary of Defense. This guidance did not contain Force Capabilities Guidance as was indicated by the calendar schedule. The Tentative Fiscal Guidance did include "material support planning" guidance, previously identified as logistics support guidance. Mr. Packard noted that the budget levels in the FYDP for FY 1973-77 in the February update were considered unrealistically high and requested in the Fiscal Guidance that the JFM and PONs be prepared at much lower levels. In addition, the Fiscal Guidance requested that the FY 1973-77 JFM and POMs be based on the assumption that outlays (in FY 72 budget dollars) will remain constant at FY 77 levels in succeeding years. The Fiscal Guidance provided a table of factors to be used for converting TOA to outlays.

C. New Approach

In April the Secretary of Defense issued a Top Secret document providing planning and programming guidance for the FY 73-77 Defense Program (35.). This document was unique in that, it introduced new requirements on both the Joint Chiefs and the Military Departments. Specifically, this document included the following seven sections:

1. Interim Policy Guidance
2. Interim Force and Resource Planning Guidance
3. Fiscal Guidance
4. Southeast Asia Planning Assumptions
5. Materiel Support Planning Guidance
6. Guidance for the Preparation of POMs
7. Subjects for Selected Analysis

Although the annual calendar schedule did not address the first two items, the document stated that the purpose of the first is to provide in one document those essential National Security policies, established or confirmed by the Administration, which must guide our Defense Program. The purpose of the second section is to reflect those policies in more specific guidance regarding sizing forces and allocating resources. This guidance is based on Part 2 of Volume I of the JSOP 73-77 as amended to reflect decisions made by the President or those made by the Secretary of Defense.

Since these two sections represent a substantial new step in planning guidance, the Secretary of Defense issued them as iterim guidance sections, ". . .to give me an opportunity to consider your comments and suggestions before issuing them in final form." Comments were requested by May 12 and the final version was to be issued on May 21. Planning was to be based on the interim sections.

D. Implementation of Policy

Mr. Laird made it clear once again that, consistent with the management philosophy which he enunciated when the present Defense management team was first assembled, the initiative to propose programs to implement our Defense policies rests with the JCS and the Services. This was reiterated in the PPGM issued in April.

E. Guidance for POM Preparation

Although in the PPGM there was a section devoted to the preparation of the Service's POMs, the section also stated that the specifics of the guidance would be forthcoming from the ASD(SA). On May 6 the ASD(SA) provided specific guidance (36.) on the POM preparation following the outline originally displayed in the April PPGM.

F. Program Element Expansion

It became apparent to the Director, Defense Research and Engineering (DDR&E) that the number of program elements in Program 6 were expanding at a far too rapid pace. In March 1971 there were 609 elements in Program 6 with a total of 1406 for all programs. Early in May the DDR&E issued a memorandum (37.) to the Assistant Secretaries of the Military Departments (R&D) suggesting that they consolidate many of the smaller projects into existing elements and accomplish this in a manner to have approximately 100 program elements per Service as a reasonable target.

G. Schedule for Decision Making (Program)

In June, for the first time (and not included in the annual calendar schedule), the Deputy Secretary of Defense issued a memorandum (38.) to the Director, Defense Research and Engineering, Assistant Secretaries of Defense and the Assistants to the Secretary of Defense, outlining the specific schedule to be followed in processing of issue papers and outlining the issue dates of the POMs. This memorandum designated a "primary action office" for each issue paper and delegated the responsibility to that office for both the preparation of the issue paper and for reviewing any reclamas received. A copy of this memorandum was given to the Secretaries of the Military Departments, Chairman of the Joint Chiefs of Staff and the Directors of Defense Agencies for their information.

H. Budget Guidance

The budget guidance (39.) issued in August stated that the FY 73 estimates must be based on the program and outlay levels contained in the basic POMs submitted in June, as adjusted by program changes reflected in the Program Decision Memorandums scheduled to be issued on September 1. The guidance also provided that financial requirements for some areas such as portions of the All Volunteer Force program, future pay raises and retired pay CPI increases would be included in a Defense-wide contingency amount.

I. Schedule for Decision Making (Budget)

In October a joint memorandum (40.) of understanding was signed by both OASD(C) and OASD(SA) which outlined, not specific dates, but a schedule of specific actions that must take place prior to processing of any PBD. This action was taken by these offices to insure that the force and support programs be kept in balance and that a programmatic view of the current and outyear programs be retained. Additionally, the Secretary of Defense plans to issue outyear control totals for each Service and Agency to follow in preparing the January 1972 FYDP update. These control totals were to be a projection of the outyear impact of the PBDs, therefore, PBDs must reflect a coordinated position on the available alternatives and their impact on the total Defense program including the outyears.

This memorandum confirmed the participation of Systems Analysis representatives in local budget hearings enabling them to provide the Systems Analysis recommendation to the DASD(C) representative. Additionally, this memorandum

specified that the DASD(C) will be responsible for obtaining coordination on all PBDs from the OASD(SA) prior to submission to the ASD(C) or the Secretary of Defense. This required a 48 hour turn-around time during the months of October and November and a 24 hour turn-around time in December.

J. Responsibility Assignments

In line with his previously declared policy on the assignment of responsibility within the Department of Defense, the Secretary of Defense in a memorandum issued by Mr. Packard on November 3, 1971, established the Office of the Assistant Secretary of Defense (Intelligence), and disestablished the Office of the Assistant Secretary of Defense (Administration). The responsibility previously identified with the Administration office, with the exception of the Intelligence functions, were assigned to the ASD(C). In December, Mr. Laird announced the establishment of the Defense Investigative Service (DIS) as a separate Defense Agency reporting directly to the Secretary of Defense.

K. Resignations

Mr. David Packard, the Deputy Secretary of Defense, resigned his position with the Department of Defense on December 13, 1971.

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Calendar Memorandum

Although the CY 1972 memorandum (41.) was signed by Secretary Laird and issued in January to activate the CY 72 schedule, the schedule was not without its share of discussion. The draft of the schedule was given to the PPBS Improvement Working Group for review in October 1971. The early review was necessary since PPBS was passing through a transition period which created some concern about the kind of documentation needed, the proper labeling of the documents decided on, and because of the introduction by Mr. Laird of the policy guidance and force and resource planning sections in last year's cycle which had not been scheduled as a part of the 1971 calendar.

The 1971 cycle was considered a successful one. Still to be accomplished in the 1972 cycle was to put the required documents in proper perspective, and to insure that sufficient time was allotted to permit proper review. The 1971-1972 transition period proved that the system could stand improvement in information documentation and timing. The 1972 CY schedule

introduced the following specific improvements over the 1971 calendar:

1. Significant increases in the time allowed for the preparation of the JFM and the POMs.

2. Significant increases in the time allotted the Secretary of Defense for making Program decisions.

3. Issuance of the DPPG early enough to be useful in the preparation of the JSOP Vol. II.

4. Elimination of JSOP Vol. III. The "Free World Forces" information was to be added to JSOP Vol. II.

5. Discontinued issuance of separate OSD Strategy Guidance.

6. Discontinued issuance of Force Capabilities Estimates.

7. Elimination of DoD analysis of Strategies, Capabilities and Costs to the DPRC/NSC.

8. Recognition of Selected Analysis Topics earlier in the cycle.

9. Introduction and scheduling of the "Issue Papers." These documents were a part of the CY 71 cycle, however, were not identified in the calendar memorandum.

10. Elimination of the Tentative Fiscal Guidance.

Issue Papers

The introduction of the issue papers into the mainstream of the PPBS cycle was accomplished after recognizing their value in the previous cycle. Issue papers are the documentation of major decision points surfacing as a result of the evaluation of the JFM and the Components' POMs by the various Secretary of Defense staff activities. Issue papers must include the relation of the proposed programs to four criteria: (1) the guidance provided in the PPGM, (2) the balance between force structure, modernization, materiel support and readiness, (3) efficiency and effectiveness trade-offs, and (4) subjects addressed in the Selected Analysis. Each issue paper must define the issue, note the alternatives, and evaluate the capabilities and costs of alternatives in terms of the ability to implement the DoD strategy. There is a scheduled four day turn-around time for the Components to review and return all issue papers.

Unscheduled Delays

The CY 1972 calendar schedule was hardly underway when a slippage in the schedule occurred. Since the FYDP is the point of departure for the following cycle, it is therefore mandatory that the FYDP update be as accurate as possible and must be consistent with the President's Budget. The January FYDP update was not submitted at the scheduled time by the Components because the outyear control totals which were to be based on a projection of the outyear impacts of the PBDs were delayed. The FYDP update took place on February 4, 1972, and therefore caused a slippage of the issuance of the PPGM until March.

Fiscal Guidance Categories

The OASD(SA) staff created a classification system known as Fiscal Guidance Categories (42.) designed to aggregate the currently approved program elements of the FYDP into meaningful groupings of: Force Mission, Other Mission, General Support, Miscellaneous Costs. These aggregations are used to transmit the annual fiscal guidance and also by the Components and the JCS to transmit detailed resource proposals in both POMs and the JFM. These aggregations are also used in the presentation of the PDMs by the Secretary of Defense.

Organizational Changes

The Secretary of Defense announced the establishment of a new ASD to become effective January 11, 1972 and known as Assistant Secretary of Defense (Telecommunications). Previously, Telecommunications was the responsibility of an Assistant to the Secretary. The establishment of this additional ASD was facilitated by Congressional authorization of a ninth Assistant Secretary in the Department of Defense. Also, a second Deputy Secretary of Defense was authorized by Congressional authorization in October 1972. The second position has yet to be filled.

Planning and Programming Guidance Memorandum (PPGM)

In March 1972 Secretary Laird signed and issued the PPGM for the FY 74-78 Defense Program (43.). The PPGM for 1971 was issued as a Top Secret document and thus minimized its usefulness since the distribution was restricted by that classification. The 1972 document was classed as Secret and greater distribution was made to the working project officers. In comparison with the 1971 document, the PPGM for 1972 contained only four sections whereas the 1971

document contained seven sections. The four sections were (1) Defense Policy and Planning Guidance, (2) Fiscal Guidance, (3) Materiel Support Planning Guidance, (4) Guidance for POM Preparation. Missing were (1) Southeast Asia Planning Assumptions which was separately issued as a Top Secret document, (2) Subjects for Selected Analysis (which was issued in December 1971), and (3) the Interim Policy Guidance and Interim Force and Resource Planning Guidance of last year. These two sections became the Defense Policy and Planning Guidance for this year.

Mr. Laird left the door open to the JCS and Components to offer any other program options at the Fiscal Guidance level. He suggested, however, that such options be submitted as a separate addendum to the JFM or POMs. The options were to be accompanied by a list of recommended additions and offsetting program reductions of approximately equal annual costs, together with the rationale for recommending them.

POM Guidance

Also in March a detailed memorandum for the preparation of POMs was issued by the ASD(SA) (44.). This issuance provided the Components necessary guidance to insure the submission of POMs that could be reviewed and evaluated in the most efficient manner by the Secretary's staff.

Program Review and Decision Cycle

In June, 1972 Mr. Kenneth Rush, then the Deputy Secretary vice Mr. Packard, distributed a memorandum (45.) to the OSD outlining the five major steps of the program review and decision cycle:

1. Review of the POMs - June
2. Make Decisions based on the POMs and Issue Papers - July
3. Distribute PDMs - July/August
4. Re-review entire program - emphasis on reclamas - August
5. Issue final program guidance - last week in August

Secretaries of the Military Departments, Chairman of the Joint Chiefs of Staff and Directors of Defense Agencies received copies of this memorandum for information. Attached was an "Issue Paper Calendar" which outlined the thirteen issue papers their review dates by ASD(SA), their review dates for interdepartmental review and the date to be sent to SecDef or DepSecDef.

Congressional Interest in FYDP

During the presentation of his Posture Statement for FY 71, Secretary Laird stated, "We confidently expect to be in a position next year to present to the Congress our proposed five year Defense program." This statement was followed up by Senator John C. Stennis and a request for the FYDP information was made. In a response memorandum to Senator Stennis as Chairman of the Committee on Armed Services, Mr. Laird on February 23, 1971, wrote "My Defense Report [Posture Statement], which will be presented to Congress in the near future, will cover our projections of force needs for the period FY 1972-1976 similar to previous Defense Reports. Consistent with past policy however, my Report will not deal with dollar levels beyond the budget year, and I regret if there was any misunderstanding on this point as a result of my testimony last year." On May 30, 1972, the Senate proposed legislation (S.3650) to provide for transmittal of the DoD Five Year Defense Program to the Congress. On June 1, 1972, the House proposed similar legislation (H.R. 15260).

In May 1972, the Honorable C. B. Rangel, Congressman, requested a copy of the FYDP pursuant to the Freedom of Information Act. His request was rejected on the basis that the document requested is an internal working document and is classified SECRET and is therefore not releaseable under the Freedom of Information Act.

Congressional Interest in Program Structure

In March 1971, The Director, Defense Research and Engineering, requested that the total number of program elements in program 6 be reduced by consolidation. This action was accomplished by the Military Departments and the budget was transmitted using the lesser number of program elements. In July 1972, a report by the Committee on Armed Services, U. S. Senate, Report Number 92-962, pages 107-110 and a similar House Appropriation Committee Report 92-1389, page 204, discuss concern about recent consolidations of RDT&E program elements and the resulting lack of visibility and difficulty in tracking program content. The reports recommended the reestablishment of certain program elements previously eliminated from the program structure and the addition of other elements to attain the visibility required. The program 6 program elements increased from 495 in February of 1972 to 636 in January 1973.

Budget Guidance

In August, Mr. Moot (ASD(C)) initiated revised FY 1973 and FY 1974 Budget Estimates Guidance (46.). This memorandum spelled out specific items to be included in both the FY 73 and FY 74 estimates and also provided a "General" section which included language in reference to the handling of the All Volunteer Force Program, tentative PDM decisions, future civilian and military pay raises and of equal importance this memorandum included a table for adjusting outlay rates by appropriation for developing revised FY 73 and FY 74 estimates.

Selected Analysis

In December, Mr. Rush, Deputy Secretary of Defense, issued a memorandum (47.) emphasizing the importance of the use of Selected Analysis. His memorandum requested that the Selected Analysis be performed early in the PPBS cycle since the results of such analysis should be known in advance of the submission of the JFM or POMs to assist in their final formulation within fiscal and policy limitations. This memorandum requested submission of the selected analysis no later than March 30, 1973, unless, by mutual agreement with the ASD(SA), the March 30 deadline was inappropriate for a specific analysis. A list of topics on which selected analysis should be performed was enclosed.

1 9 7 3

Calendar Memorandum

As in the past years, the CY 1973 cycle was initiated with the signing and issuing of the Calendar Memorandum (48.). The Calendar Memorandum reminded the Components that the Planning cycle started with the issuance of JSOP Vol I (May 19, 1972) and would be considered complete by February 23, 1973. The Programming cycle was to commence on the same date upon issuance of the Planning and Programming Guidance Memorandum. The Programming cycle will continue through the preparation of the JFM and the review of these documents, and the transmittal of decisions on specific issue papers. The Programming cycle was scheduled to be completed on August 17, 1973. The Budget cycle was to commence upon release of the Budget Guidance on August 17, 1973 and would continue through the submission of the annual budget estimates, the review and evaluation of the estimates by both OSD and OMB and the transmittal of budget decisions

in the form of PBDs. The Budget cycle was considered completed after the FYDP update and the joint meetings with the JCS, Service Secretaries and the SecDef to resolve any outstanding budget issues. The SecDef meeting was scheduled for December 7, 1973.

Unanticipated Delays

There were unanticipated delays in the schedule for this cycle. The first came early in the cycle when the FYDP update, scheduled for January 19, 1973, did not take place until February 2, 1973. This necessarily caused the slippage of other significant dates in the schedule. Specifically, the issuance of the PPGM which was scheduled for February 23 but issued in March. Notwithstanding these early delays, the POM and JFM input dates remained unchanged thereby bringing the original schedule back on track.

Planning, Programming Guidance Memorandum (PPGM)

As stated, the PPGM was late according to the original schedule and was signed out (49.) by new Secretary of Defense, the Honorable Elliot L. Richardson. There was no significant changes in the PPGM for the 1973 cycle. The Defense Policy Guidance (stated in the PPGM), set forth the same basic policies as previously stated by Mr. Laird and the President's Strategy for Peace as designed to implement the Nixon Doctrine. The Fiscal Guidance section again allowed the JCS and the Components to submit other program options as separate addendum to the JFM or POMs within the published fiscal guidance levels.

Personnel Changes and Reorganization

As previously indicated, Mr. Laird resigned January 29, 1973, and the Honorable Elliot L. Richardson became the new Secretary of Defense on January 30, 1973. Also on January 29, 1973, Mr. Rush resigned as Deputy Secretary of Defense and on January 30, 1973, the Honorable William P. Clements became the new Deputy Secretary of Defense.

On April 17, 1973, the Secretary of Defense disestablished the position of the Assistant Secretary of Defense (Systems Analysis) and redesignated it as the Director of Program Analysis and Evaluation (PA&E). Also, the Secretary on the same date established a new Assistant Secretary of Defense for Legislative Affairs, the Honorable John O. Marsh, Jr. The Army, the Honorable Howard H. Calloway, and Air Force, the Honorable John L. McLucas, both had new Secretaries

appointed during this period. Likewise, the Honorable John S. Foster, the Director of DR&E, was replaced by the Honorable Malcolm R. Currie on June 21, 1973, and the Honorable Robert C. Moot, the ASD(C), was replaced by the Honorable Terence E. McClary, who was confirmed on June 21, 1973. On May 24, 1973, the Honorable Elliot L. Richardson resigned as Secretary of Defense and the Honorable James R. Schlesinger was sworn in as Secretary on July 2, 1973.

Emphasis on PPBS by M&RA

On March 15, 1973, the Principal Deputy Assistant Secretary of Defense, Manpower and Reserve Affairs, Lt. Gen. R. C. Taber issued a memorandum to his internal staff offices calling attention to the need for improved M&RA participation in the DoD PPBS. This memorandum was designed to reemphasize to top M&RA management the documentation involved in the total PPBS cycle starting with the Calendar Memorandum and commenting on the use of each document by M&RA staffs throughout the cycle.

POM Preparation Guidance

The POM Guidance was issued in April consistent with the information and outline included in the PPGM (50.). It was apparent that significant stabilization of the format and content of the POMs had been achieved since there was nothing of a substantive nature different in this guidance than the prior year's issuance.

Telecommunications Subsystem

The advent of a new ASD(Telecommunications) gave rise to the need for resource information prompting development of a special system to collect such information. On February 27, 1972, DoDI 7045.12, entitled, "The FYDP Telecommunications Subsystem" was issued to all Components. The 1973 Calendar Memorandum requested the first input resulting from the use of this data gathering medium. The Subsystem is designed to provide total visibility of telecommunications resources within the PPBS.

Policy Guidance

In September, the Defense Policy and Planning Guidance (DPPG) was issued by Secretary Schlesinger (51.). This issuance marked a return to schedule execution for this document. (While scheduled to be issued in September 1972, the force of events resulted in it not being issued that year.)

The transmittal memorandum stated that the document provided the basic framework for Defense planning and programming but recognized that more specific guidance would be needed and that it would be provided, after review of Volume II of JSOP, in the PPGM to be issued early in 1974.

FOOTNOTES

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3. Department of Defense Directive 7045.1. "DoD Programming System," February 13, 1964.

4. Department of Defense Directive 7041.1. "Cost and Economic Information Systems," July 7, 1964.

5. Department of Defense Instruction 7045.2. "DoD Programming System, Procedures for Program Changes," January 29, 1965.

6. Department of Defense Instruction 7045.3. "DoD Programming System, Program Element Summary and Descriptive Data Sheets," January 29, 1965.

7. Department of Defense Instruction 7045.4. "DoD Programming System, Procedures for Updating the Five Year Force Structure and Financial Program (FYFS&FP)," January 29, 1965.

8. McNamara, Robert S. Multiaddressed Memorandum. "Program/Budget Reviews - Calendar Year 1966 Schedule," March 12, 1966.

9. Anthony, Robert N. Multiaddressed Memorandum. "Interim Operating Procedure No. 1 - Major Force-Oriented Issues," June 29, 1966.

10. Anthony, Robert N. Multiaddressed Memorandum. "Interim Operating Procedure No. 2 - Program Change Requests (PCRs)," June 30, 1966.

11. Anthony, Robert N. Multiaddressed Memorandum. "Interim Operating Procedure No. 3 - Procedures for Updating the Five Year Defense Program (FYDP)," August 11, 1966.

12. Anthony, Robert N. Multiaddressed Memorandum. "Interim Operating Procedure No. 4 - Program/Budget Structure Changes," August 25, 1966.

13. Department of Defense Directive 7000.1. "Resource Management Systems of the Department of Defense," August 22, 1966.

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15. McNamara, Robert S. Multiaddressed Memorandum. "Budget Reviews - Calendar Year 1967 Schedule," May 24, 1967.

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19. Department of Defense Instruction 7000.5. "Operations Subsystem to the Five Year Defense Program," June 5, 1968.

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21. Department of Defense Instruction 7220.22. "Accounting System for Operations," May 16, 1968.

22. Nitze, Paul H. Multiaddressed Memorandum. "Program/Budget Reviews - Calendar Year 1968 Schedule," June 15, 1968.

23. Moot, Robert C. Multiaddressed Memorandum. "Establishment of a Working Group," September 28, 1968.

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26. Packard, David. Multiaddressed Memorandum. "Interim Operating Procedure (IOP) Number 1--Processing of Program Change Requests (PCRs) and Program Change Decisions (PCDs)," June 21, 1969.

27. Department of Defense Instruction 7045.7. "The Planning, Programming, and Budgeting System," October 29, 1969.

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31. Packard, David. Multiaddressed Memorandum. "Preparation for NSC Review of Fiscal Problems," June 19, 1970.

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THE LEGISLATIVE PROCESS

The Secretary of the Air Force and the Chief of Staff are the lead Air Force witnesses to testify before Congressional Committees such as the Armed Services Committees and the Defense Subcommittees of the Appropriations Committees. The Secretary and Chief describe accomplishments in the previous calendar year and present the annual Air Force request for Authorization and Appropriation of funds for proposed Air Force programs.

The prepared statements of the Secretary and Chief are the principal Air Force appropriation and authorization presentations to the Congress and are an extension of the President's State of the Union message and the annual SECDEF Defense Report.

THE PRESIDENT'S STATE OF THE UNION MESSAGE

The legislative year begins when the President goes to the Congress to report on the condition of the nation, its relations with other nations, the goals he has set for the nation, and the legislative program he proposes in order to reach these goals. The Constitution requires this annual report by the President to Congress as a part of the system of checks and balances between the Legislative and Executive Branches. The President's State of the Union message is often confused with the President's budget proposal, but these are separate and distinct events.

THE PRESIDENT'S BUDGET

The President is required by law to submit his proposed budget within the first 15 days after Congress convenes. His budget presentation initiates the annual budget enactment process in Congress.

The Congressional Budget and Impoundment Control Act of 1974 will require a number of changes in the presentation and enactment of authorizations and appropriations. The

provisions of the act became effective in FY 1977; however, the Congress tested the procedures during FY 76/7T authorization and appropriations cycle.

Significant events which will occur during the FY 7X+1 cycle are:

- Submission of Current Services Budget - 10 November FY 7X.
- Submission of President's Budget - 15 days after Congress convenes in January. This will include not only FY 7X+1, but also FY 7X+2 authorization requests.
- Committees submit reports to Budget Committees - 15 March FY 7X.
- Congressional Budget Officer submits report to Budget Committees - 1 April FY 7X.
- First update of President's Budget - 10 April FY 7X.
- Budget Committees report first concurrent resolution to their houses - 15 April FY 7X.
- Authorization Committees report bills - 15 May FY 7X.
- Second update of President's Budget - 10 July FY 7X.
- Congress completes action on authorization and appropriation - seventh day after Labor Day.
- Congress completes action on second concurrent resolution - 15 September FY 7X.

The President's budget presentation to Congress is followed by more detailed reports by the heads of various departments in the Executive Branch. Each department or agency in the Executive Branch has a committee in Congress to whom it is responsible. Over the years, a custom has developed which requires the chief executive of each agency to make a personal report to his parent committee. These reports are a continuation and amplification of the President's State of the Union message.

MILITARY POSTURE PRESENTATIONS

The Department of Defense's version of the annual State of the Union message is known as The Defense Report and is delivered by the SECDEF, supported by the Chairman of the Joint Chiefs of Staff, to the Defense Appropriations Subcommittee and Armed Service Committees of the House and Senate. The SECDEF/JCS report is followed by posture statements from each of the military departments. The Air Force's Posture Statement is made jointly by the Secretary and the Chief of Staff. Although they deliver separate prepared statements, they appear before Congress as a team representing the Air Force.

There are, of course, major differences between the President's "State of the Union" message and the Air Force Military Posture Statement. When the President addresses Congress, the members of both Houses of Congress gather in the chamber of the House of Representatives, and the President delivers his statement to his joint assembly. The President is not personally available to respond to Congressional questioning on his message. The Secretary and the Chief of Staff appear before the perspective Armed Services Committees. They may request to make some extemporaneous remarks in lieu of reading the entire statement or read an abbreviated version (called a "Blue Line" version) of their statements to the Committees. In either case, both the Secretary's and the Chief's formal prepared statements are submitted in their entirety for inclusion in the formal record of the hearing. When the Secretary and Chief of Staff finish their presentation, they are questioned by the committee on the contents of their statements or other subjects of interest to the committee. An exact transcript is made to the questions asked and the answers given, and that transcript becomes a part of a permanent record of the hearings.

AUTHORIZATION AND APPROPRIATION

A few years ago the only authorization hearings were for military construction projects. Air Force programs were developed from gross authorizations contained in the Army and Air Force Authorization Act of 1949. Numerous amendments have been made since that time and now the hearings cover almost the entire spectrum of military expenditures.

The authorization hearings were originally required by Section 412(b) of Public Law 86-149 and are, therefore,

sometimes referred to as the 412(b) hearings. However, in 1973 these enactments were codified into Title 10, U.S. Code as Section 138 so that it is now more properly referred to as Sec. 138 Hearings.

The Appropriations hearings are the responsibility of the Director of the Budget; however, since the Secretary and the Chief of Staff use essentially the same prepared statements and backup material during the appropriations hearings as they use for their Military Posture presentation, the Posture Team also supports their Appropriations Committee appearances. This support includes the preparation of the Chief of Staff's statement, the review of the transcript of the Secretary's and the Chief of Staff's testimony, and preparation of inserts for the record in a manner similar to the authorization hearings.

After the Secretary and Chief of Staff conclude their appearance before the Armed Services Committees and Defense Appropriations Subcommittees, certain DCSs, Directors, and other key Air Force officials appear to provide more detailed justification of Air Force programs.

Typically the Secretary of the Chief of Staff presently appear as witnesses before four congressional committees: The House Armed Services Committee (HASC), The House Subcommittee on Defense Appropriations (HAC), The Senate Armed Services Committee (SASC), and The Senate Subcommittee on Defense Appropriations (SAC). In previous years the Budget Committees have held some hearings at which Air Force witnesses testified. These testimonies are not required by law and are conducted on an as needed or required basis.

APPENDIX B

RANKING CRITERIA

The criteria that were developed for the appraisal methodology are contained in the Tables of this Appendix. Each table is described below.

- Table B-1 lists the criteria to be used for evaluating the relevance tree elements in determining the Need parameter as follows:
  - The criteria for objective rank (R_m) is used in evaluating the mission functions and is a measure of importance.
  - The criteria for Generic Weapons Class Rank (R_s) is used in evaluating the generic weapons and is a measure of adequacy.
  - The criteria for Subsystem Rank (R_t) is used in evaluating the subsystems and is a measure of criticality.
  - The criteria for Task Area Impact (R_a) is used in evaluating the candidate programs and is a measure of impact.
- Table B-2 lists the criteria to be used for evaluating the Return-on-Investment (ROI) parameter.
- Table B-3 lists the criteria to be used for evaluating the Uniqueness parameter.

TABLE B-1. RANKING CRITERIA

RANK	CRITERION
Objective-Rank (Rm)	
3	We fall far short of being able to do the job. We cannot counter the enemy's ability to achieve his objectives or we cannot achieve our objectives against the enemy's superior capabilities.
2	We have the capability to reach our objectives with sufficient time permitted but the expenditure rate for our resources is excessive.
1	We can at least hold our own with the enemy but cost reductions and/or improved supportability in terms of maintenance, logistical support, shelf life, etc., are necessary to achieve maximum potential of existing capability.
0	Our current capabilities are sufficiently mature that no additional resources are required at this time.
Generic Weapons Class Rank (R_s)	
3	The generic weapon offers a high probability of filling the need in both near-term and long-term.
2	The generic weapon offers a high probability of filling the need in the near-term or long term but not both.
1	The generic weapon offers an acceptable interim solution in the absence of an acceptable permanent solution.
0	Does not offer any appreciable capability over existing capability.

TABLE B-1. RANKING CRITERIA (Concluded)

RANK	CRITERION
Subsystem Rank (R_t)	
3	The generic weapon will not function without the particular subsystem and the existing state-of-the-art will not produce a satisfactory alternative.
2	The subsystem concept is essential to the system and workable but not completely satisfactory component is available.
1	A marginal increase in performance can be obtained by improving the subsystem.
0	No increase in performance is indicated.
Task Area Impact (R_a)	
3	The task is essential to the subsystem and will not delay it.
2	The task is important to the subsystem and will be time responsive.
1	The task is either not crucial to the subsystem or will delay the subsystem.
0	The task is superfluous.

TABLE B-2. RETURN ON INVESTMENT CRITERIA

RANK	PROBABILITY OF SUCCESS			GROWTH POTENTIAL	OTHER APPLICATIONS
	COST	SCHEDULE	TECHNICAL RISK		
3	As proposed	As proposed	As proposed	Major	Broad
2	Acceptable increase likely	Acceptable delay likely	Acceptable increase	Major or modest	Broad or some
1	Major increase likely	Major delay likely	Major increase	Modest or low	Some or narrow

TABLE B-3. UNIQUENESS CRITERIA

RANK	SOURCES OF AVAILABILITY
3	None
2	Domestic or Foreign Industry Foreign Government
1	Other Services or NASA

APPENDIX C

SUMMARIES OF REQUIREMENTS, CAPABILITIES, AND DEFICIENCIES

This Appendix contains summaries of requirements and generic weapon system capabilities and deficiencies to be used as planning aids in the appraisal for anti-surface missions. The mission function requirements and applicable operational missions that follow are expansions of the specific objectives and goals described in Section V of the report. Table C-1 summarizes the adequacies and deficiencies of the Generic Weapon Systems. Table C-2 combines the information relevant to the examples and was developed as an aid in clarifying the thought process used in the development of the examples. In this table, applicable targets, requirements, weapon system deficiencies and applicable operational missions are collectively present for each element in the Defensive Fire/Stand-off Guided/Guidance path of the relevance tree. From the information of Table C-2 the R-values and rationale statements for the examples were developed in conjunction with the appropriate criteria.

1. DEFENSIVE FIRE

a. Requirements

Capability to counter enemy defensive fire is mandatory to support friendly operations at all times, during fair and inclement weather, and within each echelon of the enemy's formations. Point accuracy is required to defeat enemy gun and artillery emplacements, surface-to-surface rocket/launch sites, and SAM sites. Required capabilities are neutralization of AAA and artillery; crew incapacitation of gun emplacements and SAM sites; single shot kill of SAM sites within the first echelon; destruction of surface-to-surface rockets (FROGS); destruction of SAMs after they are launched; and destruction of hardened SAM sites.

b. Applicable Missions

- Close Air Support
- Strategic Defense
- Interdiction
- Deep Strike
- Bomber Defense.

2. SEA LANES

a. Requirements

The capability to attack enemy shipping is required for day and night and during inclement weather since the movement of troops, equipment, and supplies is not limited by any of these conditions. Attacks against ships and port facilities will occur primarily during daylight hours. The capability to attack at night is highly desirable. Also, it is desirable to have all-weather capability for attacking port facilities to prevent weather from being a cover for increased levels of port activity. Point and linear targeting are required for damaging/destroying sea lane traffic, ships at sea, and port facilities. Area targeting is also required for port facilities and mining ports, harbors, etc. The capability to damage/destroy ships will cause delays in shipping. Secondary to this objective, heavy enemy personnel casualties will enhance anti-shipping operations. Damage to structures and personnel are required for port neutralization. Also, containment, through blockage of harbors, inlets, etc., will delay enemy movements of personnel, equipment, and supplies.

b. Applicable Missions

- Deep Strike
- Interdiction.

3. HARDENED FACILITIES

a. Requirements

Battlefield fortifications and enemy air defense network facilities are hardened facilities near the FEBA which constitute a continuous threat against our attacking forces. The capability to defeat these threats at all times and during any operational weather conditions is required. Point accuracy is required to defeat battlefield fortifications and enemy air defense network facilities. Hardened targets in the rear areas include early warning radar sites, GCI sites, command and control facilities, aircraft shelters and caves, underground POL, buried ordnance facilities, etc.

b. Applicable Missions

- Close Air Support
- Deep Strike
- Counter Air.

4. INDUSTRIAL TARGETS

a. Requirements

Permanent structures are not time criteria. Daylight attack under favorable weather conditions is the prime requirements. Although night attacks against industrial targets are not required, they are highly desirable. The requirements for an all-weather attack against industrial targets is not as firm as the requirements for day/night attacks because this class of targets is immobile and poses no immediate threat. Point, line, and area accuracy is required for the spectrum of targets to be encountered. Accuracy requirements are stringent against targets within sanction areas (surgical strike). The capability to defeat structures is required. These targets include switching center, dams, hydro-electro plants, communication centers, port facilities, etc. Civilian casualties should be minimized.

b. Applicable Missions

Deep Strike.

5. LINES OF COMMUNICATION

a. Requirements

Day, night, and all-weather attacks against supply routes will delay movements of supplies and equipment to frontal areas. Point, linear, and area accuracies are required for the spectrum of targets to be encountered (i.e., tunnel mouths, bridges, switching centers, marshaling yards, traffic on rails, roads, waterways, etc.). The capability to damage/destroy major choke points (tunnel mouths, bridges, etc.) and supply traffic elements (trucks, locomotives, rail cars, barges, etc.) is required to delay movement of supplies and equipment. Incapacitation of enemy personnel is required to degrade the support, maintenance, and operation of target facilities.

b. Applicable Missions

Interdiction.

6. AIRFIELD ATTACK

a. Requirements

Day and night capabilities to attack airfields will significantly reduce the enemy's sortie generation rate. Although enemy aircraft may not be an immediate threat during inclement weather, more damage could be inflicted when a significant number of aircraft are grounded. Point, linear, and area targeting is required to defeat specific targets (i.e., sheltered aircraft), rows and groups of aircraft, support equipment, and facilities. Destruction of aircraft and/or rendering the airfield unusable are requirements that will cause an immediate reduction of the enemy sorties generation rage. Massive collateral damage is required for long-term effects on airfield operations which would probably affect the sortie generation rate. Incapacitation of enemy personnel is required to degrade the support, maintenance, and operation of aircraft.

b. Applicable Missions

- Counter Air
- Deep Strike
- Bomber Defense.

7. VEHICLES

a. Requirements

Capability to defeat vehicles during daytime, nighttime, and inclement weather is required because of their constant use during these periods. The capability to disrupt staging areas to create disorganization among the enemy forces is required during daylight. It is highly desirable that this capability exist for nighttime and during inclement weather to further enhance the objective. Point and linear targeting is required for widely separated vehicles and convoy formations. Area targeting is required for attacks on staging areas to disrupt the

enemy forces. The targets to be defeated include tanks, ATCs, assault cars, self-propelled anti-armor vehicles and trucks, mobile surface-to-air defenses, etc. Incapacitation of personnel will significantly enhance the objective.

b. Applicable Missions

- Close Air Support
- Interdiction
- Deep Strike.

TABLE C-1. WEAPON SYSTEMS SUMMARY

0010 GP BOMBS	
ADEQUACIES	DEFICIENCIES
Detection	Detection
Day or night capability.	No all-weather capability.
	Delivery aircraft vulnerable to enemy fire (no stand-off capabilities constrained to subsonic release).
Delivery	Delivery
Multiple weapons per pass.	Inaccurate due to bomb sights, ballistics, and uncertainty in release conditions.
Destruction	Destruction
Significant blast and fragmentation kill mechanism.	Restricted use in vicinity of friendlies.
Variable MAE depending on size of bomb.	
Application can be changed with different fuze settings.	Limited effectiveness against hard point targets.
Availability	Availability
Available.	
Cost	Cost
Inexpensive.	Aircraft attrition rate high.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0020 DISPENSERS	
ADEQUACIES	DEFICIENCIES
Detection	Detection
Day or night capability.	No all-weather capability.
	Delivery aircraft vulnerable to enemy fire (no stand-off capability constrained to subsonic release).
Delivery	Delivery
Multiple weapons per pass.	Critical H.O.B.
	Radar fuze is subject to enemy jamming (early function or no function depending on fuze setting).
	Inaccurate due to bomb sights, ballistics, and varying release conditions.
Destruction	Destruction
Large MAE.	Restricted use in vicinity of friendlies.
Effective against revetted targets.	Not effective against hard structures, armor, or diesel fuel targets.
Availability	Availability
Available.	
Cost	Cost
Inexpensive.	Aircraft attrition rate high.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0030 GUN SYSTEMS	
ADEQUACIES	DEFICIENCIES
Detection Day or night capability.	Detection No all-weather capability. Delivery aircraft vulnerable to enemy fire.
Delivery Multiple weapons (projectiles) per pass. Accurate targeting (point and linear).	Delivery Constrained to direct attack line-of-sight fire.
Destruction Effective kill mechansim (combination of KE, blast, fragmentation, and in some cases, incendiary). Small MAE coupled with rapid fire excellent for point and linear targets. Can be used in close proximity to friendlies.	Destruction Limited effectiveness against hard structures, armor. Small MAE for large targets.
Availability Available.	Availability
Cost Inexpensive.	Cost Aircraft attrition rate high.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0040 ROCKETS	
ADEQUACIES	DEFICIENCIES
Detection	Detection
Day or night capability.	No all-weather capability.
	Delivery aircraft vulnerable to enemy fire.
Delivery	Delivery
Multiple weapons per pass.	Limited accuracy.
Destruction	Destruction
Effective kill mechanism (combination of KE, blast, fragmentation).	Limited effectiveness against hard structures, armor.
	Small MAE for large targets.
Small MAE coupled with multiple releases excellent for point targets.	Limited use in close proximity to friendlies.
Availability	Availability
Available.	
Cost	Cost
Inexpensive.	Aircraft attrition rate high.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0050 DIRECT ATTACK GUIDED	
ADEQUACIES	DEFICIENCIES
Detection	Detection
Day capability.	No night or all-weather capability.
Moderate stand-off.	
Delivery	Delivery
Accurate targeting.	One weapon per target/single pass.
Effective in ECM environment (except radar fuze vulnerability [dispenser]).	Critical H.O.B. (dispenser).
	Radar fuze (dispenser) subject to enemy jamming (early function/no function depending upon fuze setting).
Destruction	Destruction
Significant blast and fragmentation kill mechanism.	Restricted use in vicinity of friendlies.
Large MAE.	Limited effectiveness against hard structures, armor, and revetted targets (for surface and sub-surface detonations of unitary warheads).
Effectiveness varies with fuze settings.	
Effective against revetted targets when detonated 20 to 30 feet above ground or when dispense used.	

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0050 DIRECT ATTACK GUIDED (CONCLUDED)	
ADEQUACIES	DEFICIENCIES
Availability Available for near-term. Cost Aircraft attrition rate low.	Availability Cost Expensive.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0060 STAND-OFF GUIDED	
ADEQUACIES	DEFICIENCIES
Detection	Detection
Day capability.	No night or all-weather capability.
Stand-off, pre-programmed targets.	
Delivery	Delivery
Accurate targeting.	Subject to ECM, jamming, etc.
	One weapon per target/per single pass.
	Critical H.O.B. (dispensers).
	Dependent upon operation of emitting systems (DME, GPS, D/L).
Destruction	Destruction
Significant blast and fragmentation mechanism.	Restricted use in vicinity of friendlies.
Large MAE.	Limited effectiveness against hard structures, armor, and revetted targets (for surface and sub-surface detonation of unitary warheads).
Effectiveness varies with fuze setting.	
Effective against revetted targets when detonated 20 to 30 feet above ground (unitary) or when dispenser is used.	

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0060 STAND-OFF GUIDED (CONCLUDED)	
ADEQUACIES	DEFICIENCIES
Availability	Availability Available for long-term.
Cost Aircraft attrition rate high.	Cost Expensive.

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0070 TARGET ACTIVATED	
ADEQUACIES	DISCREPANCIES
Detection	Detection
Day or night capability.	No all-weather capability.
	Delivery aircraft vulnerable to enemy fire (no stand-off capability subsonic release).
Delivery	Delivery
Multiple weapons per pass.	Critical H.O.B.
	Radar fuze is subject to enemy jamming (early function or no function depending on fuze setting).
	Inaccurate due to bomb sights, ballistics, and varying release conditions.
Destruction	Destruction
Significant blast and fragmentation for point targets.	Impedes movement of friendlies.
	Not effective against hard structures and revetted targets.
Effective over large areas because of dispenser patterns.	
Potential for defeating armor.	
Impedes movement of enemy.	

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Continued)

0070 TARGET ACTIVATED (CONCLUDED)	
ADEQUACIES	DISCREPANCIES
Availability Available. Cost Inexpensive.	Availability No armor defeating mines available. Cost

TABLE C-1. WEAPON SYSTEMS SUMMARY
(Concluded)

0080 FLAME AND INCENDIARY	
ADEQUACIES	DEFICIENCIES
Detection Day or night.	Detection No all-weather capability. Delivery aircraft vulnerable to enemy fire (no stand-off capability; subsonic release).
Delivery Multiple weapons per pass.	Delivery Inaccurate due to bomb sights, ballistics, and varying release conditions.
Destruction Large MAE. Enhances performance of explosive/fragmentation warheads against POL targets, fuel tanks, etc.	Destruction Kill mechanism ineffective against majority of targets.
Availability Available.	Availability
Cost Inexpensive.	Cost Aircraft attrition rate high.

TABLE C-2. REQUIREMENTS AND DEFICIENCIES

MISSION FUNCTION: Defensive Fire

TARGETS: AAA Artillery, SAMs, and SAM Sites, Surface-to-Surface Rockets, personnel.	
REQUIREMENTS: Capability to counter enemy defensive fire is mandatory to support friendly operations at all times, during fair and inclement weather, and within each echelon of the enemy formations. Point accuracy is required to defeat enemy gun and artillery remplacements, surface-to-surface rocket launch sites, and SAM sites. Required capabilities are 1) neutralization of AAA and artillery; 2) crew incapacitation of gun emplacements and SAM sites; 3) single shot kill of SAM sites within the first echelon; 4) destruction of surface-to-surface rockets; 5) destruction of SAMs after they are launched; and 6) destruction of hardened SAM sites.	
DEFICIENCIES	OPERATIONAL MISSIONS
Limited all-weather capability. Except for stand-off weapons, delivery aircraft is vulnerable to enemy fire. Limited night and range capability for guided weapons. Except for guns and guided weapons, delivery is inaccurate because of inaccurate bomb sights, variable ballistics, and uncertainty in release conditions. The HOB for dispensers is critical for optimum dispersion. Radar fuzes for dispensers are subject to enemy jamming. There are no kill mechanisms for hardened SAM sites artillery, and hardened AAA sites.	Interdiction Close Air Support Counter Air Deep Strike Strategic Defense Bomber Defense
Except for guns, the use of air delivered weapons in the vicinity of friendlies is restricted because of inaccuracies and large MAE. The use of mines may impede the movement of friendlies.	Close Air Support
There are no effective weapons against hardened SAM sites or SAMs after they are launched.	Bomber Defense Deep Strike

TABLE C-2. REQUIREMENTS AND DEFICIENCIES (Concluded)

GENERIC WEAPON: Stand-Off Guided

TARGETS: Hardened SAM Sites	
REQUIREMENTS: Stand-off weapons are required for high-value targets well behind the FEBA. Of the defensive fire targets, the hardened SAM sites represent the only targets of this class. Because of the prevailing inclement weather that is expected in the threat environment, an all-weather capability to attack the sites is required. Point accuracy coupled with a hard structure penetrating warhead is required of the weapon systems to be used against the hardened SAM sites.	
DEFICIENCIES	OPERATIONAL MISSIONS
Limited all-weather capability. Limited night capability. Limited range. No hard-structure penetrating warhead.	Deep Strike Bomber Defense

SUBSYSTEM: Guidance

TARGETS: Hardened SAM Sites	
REQUIREMENTS: An all-weather, long range capability is required to defeat hardened SAM sites well behind the FEBA. A passive guidance system is preferred. A highly accurate guidance subsystem is needed for the point targeting requirements.	
DEFICIENCIES	OPERATIONAL MISSIONS
Limited all-weather capability. Limited night capability. Limited range.	Deep Strike Bomber Defense

APPENDIX D

EXAMPLE WORKSHEETS FOR THE APPRAISAL

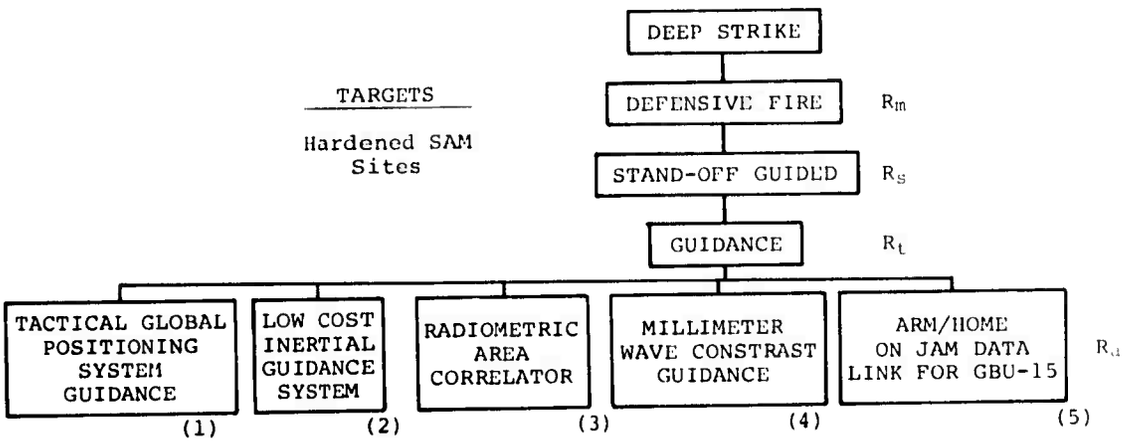
This Appendix displays the worksheets which were used to develop the examples in Section VI of this document. Blank worksheets will be provided in the data package for the Panel's use during its evaluation.

They are:

- Appraisal Worksheets
  - Multiple Programs/Single Path (Figure D-1)
  - Single Program/Multipaths (Figure D-2)
- Reduction Matrix (Table D-1)
- Return-on-Investment Scoring Sheet (Table D-2)
- Initial Screening Process Scoring Sheet (Figure D-3).

The purpose and use of these worksheets are fully described in Section VI of this document.

APPRAISAL WORKSHEET



R-VALUE	RATIONALE
$R_m = 3$	We do not have the capability to defeat hardened SAM sites.
$R_S = 2$	With a hard structures warhead and all-weather, long range guidance, we will have the capability to defeat the threat. Integration of a hard structure penetrating warhead into the stand-off guided weapon is not expected in the near-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range and weather limited relative to projected stand-off weapon capabilities and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_{a1} = 3$	The subsystem when used in conjunction with an inertial guidance system will result in a capability to meet all-weather delivery requirements, worldwide, with the required accuracy and range. The subsystem will have high resistance to jamming.

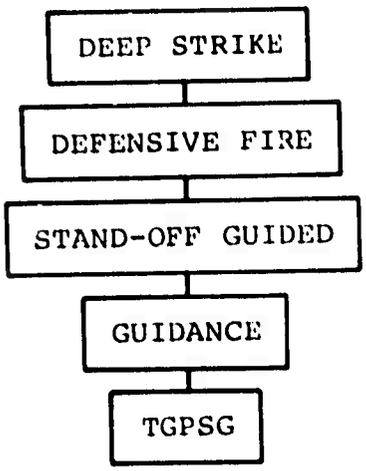
Figure D-1. Appraisal Worksheet Example (Multiple Programs/Single Path)

R-VALUE	RATIONALE
$R_{a2} = 3$	The subsystem, when used with a subsystem that provides error corrections, will result in a capability to meet the all-weather delivery requirements with the required accuracy and range.
$R_{a3} = 2$	The subsystem will result in a capability to meet the all-weather delivery requirements with the required accuracy and range. The passive guidance subsystem is ineffective over the open seas.
$R_{a4} = 2$	The subsystem will result in a limited all-weather capability with required accuracy and range. The passive guidance subsystem is ineffective when used in precipitative weather conditions.
$R_{a5} = 3$	The task will provide an interim capability for stand-off guidance in an ECM environment. The subsystem is range limited and is restricted to daytime, clear weather operations.

Figure D-1. Appraisal Worksheet Example
(Multiple Programs/Single Path)
(Concluded)

TARGETS

Hardened SAM Sites



R-VALUE	RATIONALE
$R_m = 3$	We do not have the capability to defeat hardened SAM sites.
$R_s = 2$	With a hard structures warhead and all-weather, long range guidance, we will have the capability to defeat the threat. Integration of a hard structure penetrating warhead into the stand-off guided weapon is not expected in the near-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range and weather limited relative to projected stand-off weapon capabilities and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The subsystem when used in conjunction with an inertial guidance system will result in a capability to meet the all-weather delivery requirements, worldwide, with the required accuracy. The subsystem will have high resistance to jamming.

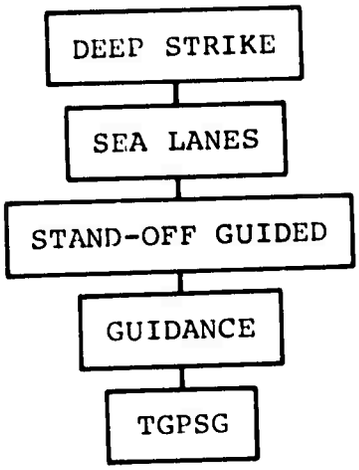
4124A01

R1 = 54

Figure D-2. Appraisal Worksheet

TARGETS

Ships at Sea



R-VALUE	RATIONALE
R_m = 3	We do not have the stand-off capability to defeat ships at sea.
R_s = 3	The capability to inflict significant damage on ships will be available in the near-term and long-term.
R_t = 3	Current stand-off guidance technology is limited to daytime, clear weather for ships at sea.
R_a = 3	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

4264A01

R_1 = 81

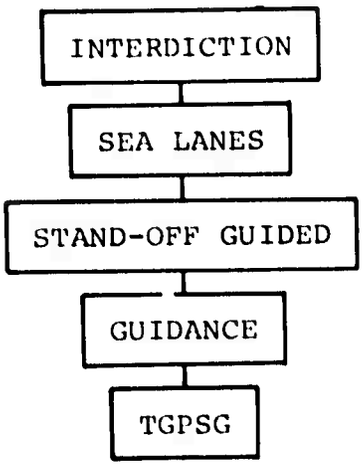
Figure D-2. Appraisal Worksheet
(Continued)

TARGETS

Port Facilities

Harbors

Sea Lane Traffic



R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against heavily defended port facilities, harbors, and sea lane traffic would result in a high attrition rate of resources.
$R_s = 3$	The capability to inflict significant damage on ships and shipping facilities will be available in the near-and far-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

1264A01

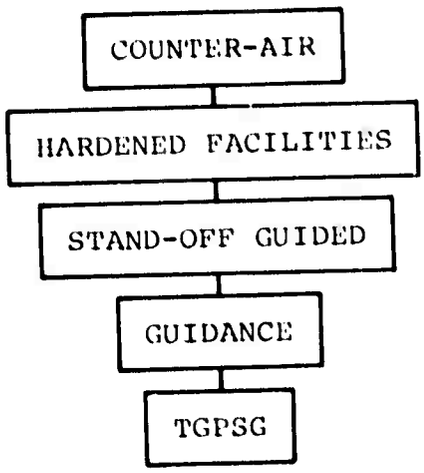
$R_1 = 54$

Figure D-2. Appraisal Worksheet (Continued)

TARGETS

Aircraft Shelters and Caves

Enemy Defense Network

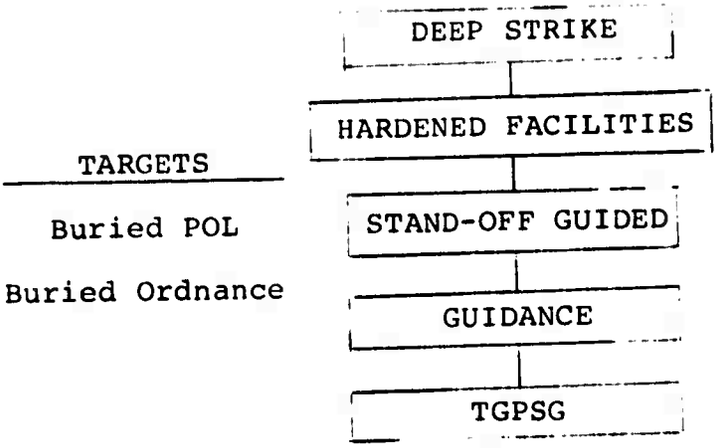


R-VALUE	RATIONALE
$R_m = 3$	We do not have the capability to defeat hardened facilities.
$R_s = 2$	With hard structures warhead and all-weather, long range guidance, we will have the capability to defeat the threat. Integration of a hard structures munition into stand-off guided weapons is not expected in the near-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet the essential all-weather delivery requirements with the required accuracy.

4364A01

$R_l = 54$

Figure D-2. Appraisal Worksheet (Continued)



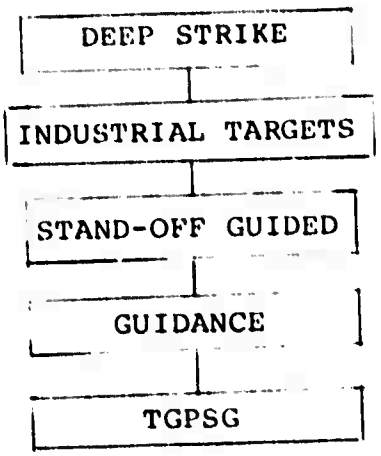
R-VALUE	RATIONALE
$R_m = 3$	We do not have the capability to defeat hardened facilities.
$R_s = 2$	With hard structure warhead and all-weather, long range guidance, we will have the capability to defeat the threat. Integration of a hard structures munition into stand-off guided weapons is not expected in the near-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet the essential all-weather delivery requirements with the required accuracy.

4364A01

$R_1 = 54$

Figure D-2. Appraisal Worksheet
(Continued)

TARGETS
Factories
Thermal Power Plants
POL Refineries
Power Switching Centers
Dams
Hydro-Electric Plants
Communication Centers
Port Facilities

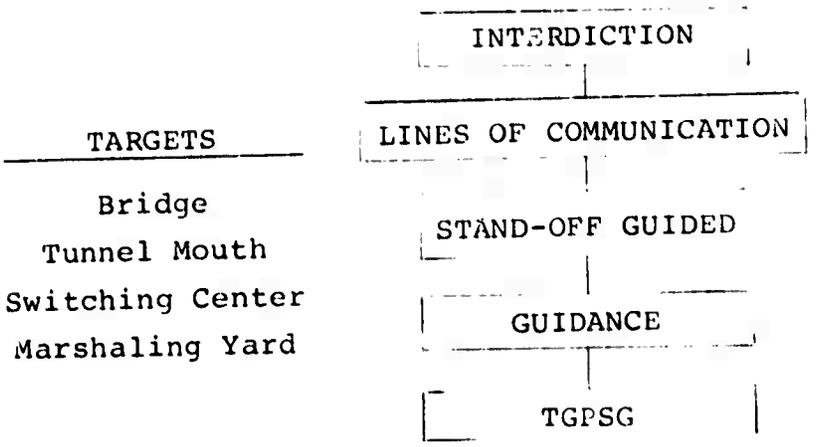


R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against industrial targets would result in a high attrition rate of resources.
$R_s = 2$	The long range capability most often required for industrial targets will not be available in the near-term.
$R_t = 3$	Current guidance technology for conventional stand-off weapons does not exist for the required ranges.
$R_a = 3$	The task will result in a capability of long range guidance for stand-off guided weapons.

4464A01

$R_1 = 36$

Figure D-2. Appraisal Worksheet
(Continued)



TARGETS
Bridge
Tunnel Mouth
Switching Center
Marshaling Yard

R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against choke points (i.e., bridge, tunnel mouth, etc.) would result in a high attrition rate of resources.
$R_s = 3$	The capability for a stand-off guided weapon to defeat choke points will be available in the near- and long-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

1564A01

$R_1 = 54$

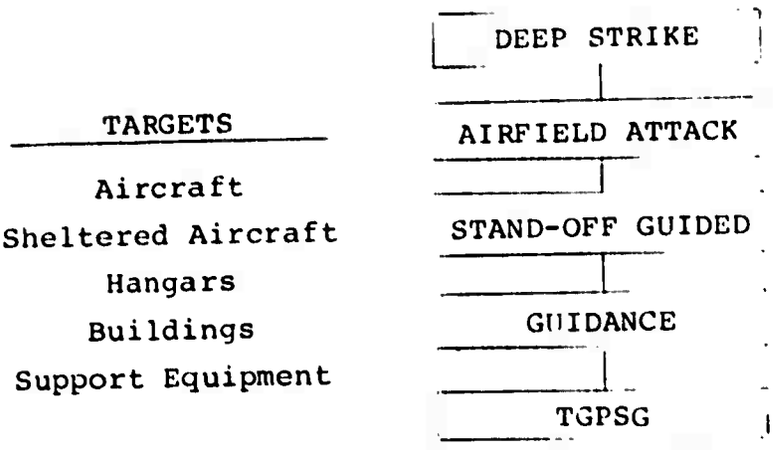
Figure D-2. Appraisal Worksheet
(Continued)

TARGETS	COUNTER AIR / AIRFIELD ATTACK / STAND-OFF GUIDED / GUIDANCE / TGPSG
Aircraft	
Sheltered Aircraft	
Hangars	
Buildings	
Support Equipment	

R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against airfields would result in a high attrition rate of resources.
$R_s = 3$	The capability to inflict damage on airfields will be available in the near-and long-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

3664A01
$K_1 = 54$

Figure D-2. Appraisal Worksheet
(Continued)

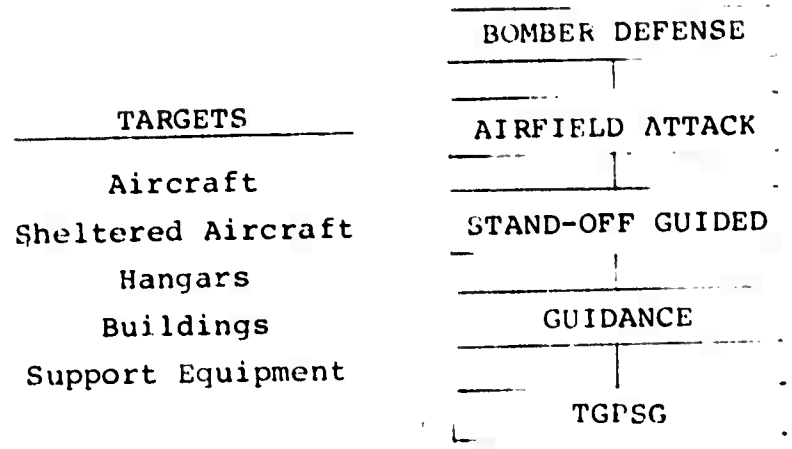


R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against airfields would result in a high attrition rate of resources.
$R_s = 3$	The capability to inflict damage on airfields will be available in the near- and long-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

4664A01

$R_l = 54$

Figure D-2. Appraisal Worksheet
(Continued)

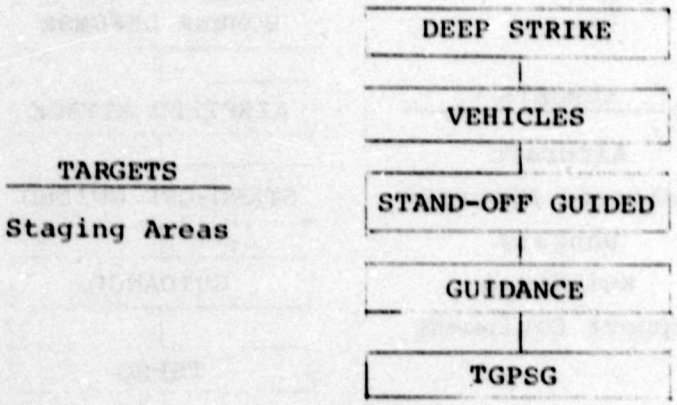


R-VALUE	RATIONALE
$R_m = 2$	Existing capabilities against airfields would result in a high attrition rate of resources.
$R_s = 3$	The capability to inflict damage on airfields will be available in the near- and long-term.
$R_t = 3$	Current stand-off guidance technology (Data Link, DME) is range limited, relative to projected SOM capabilities, and subject to enemy ECM. Data link is further restricted to daytime, clear weather use.
$R_a = 3$	The task will result in a capability to meet all-weather delivery requirements with the required accuracy and range.

6664A01

$R_1 = 54$

Figure D-2. Appraisal Worksheet
(Continued)



R-VALUE	RATIONALE
$R_m = 1$	Disruptive tactics can be more economically accomplished with lower cost weapons.
$R_s = 1$	Although an acceptable interim solution, disruption of staging areas could be more efficiently accomplished by lower cost stand-off weapons having reduced accuracy requirements.
$R_t = 2$	Lower cost guidance capability is required for area targeting.
$R_a = 1$	Alternate solutions (Data Link, DME) will be available for area targeting.

4764A01

$R_I = 2$

Figure D-2. Appraisal Worksheet (Concluded)

TABLE D-1. REDUCTION MATRIX

TASK: Tactical Global Positioning System Guidance

SUBSYSTEM: Guidance

WEAPON SYSTEM: Stand-Off Guided

DEPENDENT EFFORTS: Digital Guided Weapons Technology; Low-Cost Inertial Guidance

	MISSION					
MISSION FUNCTION	INTERDICTION	CLOSE AIR SUPPORT	COUNTER-AIR	DEEP STRIKE	STRATEGIC DEFENSE	BOMBER DEFENSE
DEFENSIVE FIRE				4[illegible]4A01 3 54		
HARDENED FACILITIES			[illegible]64A01 3 54	4[illegible]4A01 3 54		
INDUSTRIAL TARGETS				44[illegible]4A01 2 [illegible]		
LINES OF COMMUNICATION	1564A01 3 54					
AIRFIELD ATTACK			[illegible]64A01 3 54	[illegible]4A01 3 54		[illegible]4A01 3 54
VEHICLES				47[illegible]4A01 1 [illegible]		
SEA LANES	[illegible]64A01 3 54			4[illegible]4A01 3 81		

TABLE D-2. RETURN ON INVESTMENT RATING SHEET

RANK	PROBABILITY OF SUCCESS			GROWTH POTENTIAL	OTHER APPLICATIONS
	COST	SCHEDULE	TECHNICAL RISK		
3	As proposed	As proposed	As proposed	Major ✓	Broad ✓
2	Acceptable increase likely ✓	Acceptable delay likely ✓	Acceptable increase ✓	Major or modest	Broad or some
1	Major increase likely	Major delay likely	Major increase	Modest or low	Some or narrow

APPENDIX E

PROGRAM DATA FOR THE APPRAISAL

Data sheets containing pertinent program data will be a part of the data package and will provide the information needed, as described in the report, for the different phases of the appraisal. Sample data sheets are included in this Appendix. They are:

- Program Data Sheet (Figure E-1)
- Return-on-Investment Evaluation Worksheet (Figure E-2)
- Initial Screening Process Evaluation Sheet (Figure E-3).

PROGRAM TITLE: Tactical Global Positioning System Guidance

PROGRAM DESCRIPTION/STATUS/PROBLEM AREA AND TEST RESULTS:

Description: Advanced development of the TGPSG program in three phases:

- Phase I
  - Design requirements analysis
  - Design simulation, breadboard fabrication
  - Captive flight tests of breadboard installed in F-4 pod.
- Phase II
  - Repackage breadboard for recoverable flight tests
  - Integration with recoverable test vehicle
  - Free flight tests.
- Phase III
  - Repackage breadboard for GBU-15 flight tests
  - Integration with GBU-15
  - Free flight tests.

STATUS:

- Parallel, concurrent contracts awarded October 76 (Hughes/Magnavox; Teledyne)
- Contracts let for 11 months (through CDR) with options for additional 23 months (through captive flight tests in pod)
- Design Concept Phase in progress
  - SDR - Jan 77
  - PDR - Apr 77
  - IDR - Jul 77
  - CDR - Sep 77.

PROBLEM AREAS AND TEST RESULTS:

None; major area of concern is jamming.

Figure E-1. Program Data Sheet

PROGRAM TITLE: Tactical Global Positioning System Guidance (TGPSG)

PROJECT/TASK NO.: 670B02

OPR: Major DePriest | DLMM | 882-2961
Name | Organization | Phone

STARTED: Oct. 76 EXPECTED COMPLETION DATE: 1982

SCHEDULE: AHEAD _____ ON ✓ BEHIND _____ MONTHS _____

FUNDS:

FY	EXPENDED	PROJECTED
7T	XXXK	
77		XXXX K
78		XXXX K
79		XXXX K
80		XXXX K
81		XXXX K
82		XXXX K

PROGRAM MILESTONES:

Captive Flight Tests (POD)	Aug 78 - Jul 79
Recoverable Free Flight Test	Jul 80 - Feb 81
Free Flight Drop Tests	Oct 81 - Jul 82
Transition to Engineering Development	3rd Quarter 1982
Engineering Development	1983 - 1984
IOC	1st Quarter 1985

PROGRAM JUSTIFICATION:

The TGPSG program when used in conjunction with a digital integrating system and an inertial navigation system will satisfy the all-weather guidance requirements. TGPSG can be employed worldwide, day or night and will guide the weapon to the target with a high degree of accuracy. Although midcourse navigation is emphasized, the system can also be used for terminal guidance. Launch and leave tactics can be employed using TGPSG. It has high resistance to enemy jamming. The GPS is available continuously, no permission preparations are required, and it can be used by an unlimited number of users. TGPSG is cost effective because it can be used with a system in existence and no additional ground facilities are required for its operation.

LIMITATIONS:

TGPSG relies on an emitting system and can only be used against stationary targets.

Figure E-1. Program Data Sheet
(Concluded)

RETURN-ON-INVESTMENT EVALUATION WORKSHEET

PROGRAM TITLE: Tactical Global Positioning System Guidance

PROBABILITY OF SUCCESS/GROWTH POTENTIAL/OTHER APPLICATIONS:

- Probability of Success:
  - Cost: (Assessment of Potential Cost Growths)

    Source: TGPSG testing will be a highly complex effort requiring extensive coordination. As a result, numerous delays can be expected in the test program. These highly probable delays, plus unforeseen technical problems that normally accompany a developmental program will impact the program cost, if they occur.

    Estimated Increase: 10%

  - Schedule: (Assessment of Potential Delays)

    Source: A delay in any of the following concurrent developmental efforts would impact the TGPSG program: Stand-off Guided Weapons; GPS Program; Digital Integrating System; Low-Cost Inertial Guidance System. It is not unreasonable of the TGPSG program itself.

    Estimated Delay: 1 year

  - Technical Risk:

    Risk Factors: The major risk factors are the dependence of the TGPSG program on the concurrent development programs listed above. Also, the anti-jam capabilities the TGPSG receiver is uncertain and adds to the risk.

    Estimated Risk: LOW (MODERATE) HIGH

- Growth Potential:

  TGPSG has the potential for use in all long range tactical guided weapons.

- Other Applications:

  Potential applications are for the guidance of NASA and DoD space vehicles, commercial and military aircraft, and surface vessels.

Figure E-2. Examples ROI Evaluation Worksheet

APPENDIX F

EXAMPLE PROGRAM LISTINGS AND RATIONALE TABLES

A computer generated format and a table of rationale are contained in this Appendix. They are supplementary to the examples presented in Section VI of this document.

Table F-1 is the format to be used for listing candidate programs and their respective R-values for each applicable relevance tree path. The rationale indices provide references to the Rationale Table.

Table F-2 shows the example program listed under the applicable relevance tree paths. This figure was developed for illustrative purposes only. In the actual appraisal, all applicable programs will be listed under each relevance tree path as shown in Figure F-1.

Table F-3 lists the supporting rationale, with the respective indices, for the program R-value assignments. The table is divided into four parts to correspond with the Mission Function, Generic Weapon System, Subsystem, and Task Levels of the relevance tree.

TABLE F-1. CANDIDATE PROGRAM LIST

CODE		TITLE	Rm	Rs	Rt	Ra	Rl	RATIONALE INDEX
4000		DEEP STRIKE						M-1
4100		DEFENSIVE FIRE	3					S-1
4160		STAND-OFF GUIDED		2				
4164		GUIDANCE			3			T-1
4164x	1	MOVING TARGET TRACKER				2	36	A-4
4164x	2	MILLIMETER WAVE TECHNOLOGY				2	36	A-7
4164x	3	NATURAL CORRELATION DEGRADATION				2	36	A-6
4164x	4	OTHER CANDIDATE PROGRAMS						
4164x	5							
4164x	6							
4164x	7							
4164x	8							
4164x	9							
4164x	10							
4164x	11							
4164a	1	GLOBAL POSITIONING GUIDANCE SYSTEM				3	54	A-1
4164a	2	LOW COST INERTIAL GUIDANCE				3	54	A-5
4164a	3	RADIOMETRIC AREA CORRELATOR				2	36	A-6
4164a	4	MILLIMETER WAVE CONTRAST				2	36	A-7
4164a	5	ARM/HOME-ON-JAM DATA LINK				3	54	A-8
4164a	6	OTHER CANDIDATE PROGRAMS						
4164a	7							
4164a	8							
4164a	9							
4164a	10							
4164a	11							

TABLE F-2. CANDIDATE PROGRAM LISTING FOR TGPSG

CODE		TITLE	Rm	Rs	Rt	Ra	R_l	RATIONALE INDEX
4000		DEEP STRIKE						
4100		DEFENSIVE FIRE	3					M-1
4160		STAND-OFF GUIDED		2				S-1
4164		GUIDANCE			3			T-1
4164a	1	TACTICAL GPS GUIDANCE				3	54	A-1
4000		DEEP STRIKE						M-3
4200		SEA LANES	3					S-2
4260		STAND-OFF GUIDED		3				
4264		GUIDANCE			3			T-1
4264a	1	TACTICAL GPS GUIDANCE				3	81	A-1
1000		INTERDICTION						
1200		SEA LANES	3					M-3
1260		STAND-OFF GUIDED		3				S-2
1264		GUIDANCE			3			T-1
1264a	1	TACTICAL GPS GUIDANCE				3	54	A-1
3000		COUNTERAIR						
3300		HARDENED FACILITIES	3					M-4
3360		STAND-OFF GUIDED		2				S-1
3364		GUIDANCE			3			T-1
3364a	1	TACTICAL GPS GUIDANCE				3	54	A-1

TABLE F-2. CANDIDATE PROGRAM LISTING FOR TGPSG
(Continued)

CODE		TITLE	Rm	Rs	Rt	Ra	R_l	RATIONALE INDEX
4000		DEEP STRIKE						
4300		HARDENED FACILITIES	3					M-4
4360		STAND-OFF GUIDED		2				S-1
4364		GUIDANCE			3			T-1
4364a	1	TACTICAL GPS GUIDANCE				3	54	A-1
4000		DEEP STRIKE						
4400		INDUSTRIAL TARGETS	2					M-5
4460		STAND-OFF GUIDED		2				S-3
4464		GUIDANCE			3			T-2
4464a	1	TACTICAL GPS GUIDANCE				3	36	A-2
1000		INTERDICTION						
1500		LINES OF COMMUNICATION	2					M-6
1560		STAND-OFF GUIDED		3				S-4
1564		GUIDANCE			3			T-1
1564a	1	TACTICAL GPS GUIDANCE				3	54	A-1
3000		COUNTER AIR						
3600		AIRFIELD ATTACK	2					M-7
3660		STAND-OFF GUIDED		3				S-5
3664		GUIDANCE			3			T-1
3664a	1	TACTICAL GPS GUIDANCE				3	54	A-1

TABLE F-2. CANDIDATE PROGRAM LISTING FOR TGPSG
(Concluded)

CODE		TITLE	Rm	Rs	Rt	Ra	R_l	RATIONALE INDEX
4000		DEEP STRIKE	2					M-7
4600		AIRFIELD ATTACK		3				S-5
4660		STAND-OFF GUIDED			3			T-1
4664		GUIDANCE				3	54	A-1
4664a	1	TACTICAL GPS GUIDANCE						
6000		BOMBER DEFENSE	2					M-7
6600		AIRFIELD ATTACK		3				S-5
6660		STAND-OFF GUIDED			3			T-1
6664		GUIDANCE				3	54	A-1
6664a	1	TACTICAL GPS GUIDANCE						
4000		DEEP STRIKE	1					M-8
4700		VEHICLES		1				S-6
4760		STAND-OFF GUIDED			2			T-3
4764		GUIDANCE				1	2	A-3
4764a	1	TACTICAL GPS GUIDANCE						

TABLE F-3. RATIONALE

MISSION FUNCTION	
INDEX	DESCRIPTION
M-1	We do not have the capability to defeat hardened SAM sites.
M-2	Existing capabilities against heavily defended port facilities, harbors, and sea lane traffic would result in a high attrition rate of resources.
M-3	We do not have the stand-off capability to defeat ships at sea.
M-4	We do not have the capability to defeat hardened facilities.
M-5	Existing capabilities against industrial targets would result in a high attrition rate of resources.
M-6	Existing capabilities against choke points (i.e., bridge, tunnel mouth, marshaling yard) would result in a high attrition rate of resources.
M-7	Existing capabilities against airfields would result in a high attrition rate of resources.
M-8	Disruptive tactics can be accomplished more economically with lower cost weapons.

TABLE F-3. RATIONALE (Continued)

GENERIC WEAPON	
INDEX	DESCRIPTION
S-1	With hard structures warhead and all-weather, long range guidance, we will have the capability to defeat the threat. Integration of a hard structure penetration warhead into stand-off guided weapons is not expected in the near-term.
S-2	The capability to inflict damage on ships and shipping facilities will be available in the near-term and long-term.
S-3	The long range capability most often required for industrial targets will not be available in the near-term.
S-4	The capability for a stand-off guided weapon to defeat choke points will be available in both the near-and long-term.
S-5	The capability to inflict damage on airfields will be available in both the near-and long-term.
S-6	Although an acceptable interim solution, disruption of staging areas, could be more efficiently accomplished by lower cost stand-off weapons having reduced accuracy requirements.

TABLE F-3. RATIONALE (Continued)

SUBSYSTEM	
INDEX	DESCRIPTION
T-1	Current stand-off guidance technology (data link, DME) is limited to daytime, clear weather use or short ranges relative to projected stand-off guided weapon capabilities and is subject to enemy ECM.
T-2	Current guidance technology for conventional stand-off weapons does not exist for the required ranges.
T-3	Lower cost guidance capability is required for area targeting.

TABLE F-3. RATIONALE (Concluded)

TASK	
INDEX	DESCRIPTION
A-1	The subsystem, when used in conjunction with an inertial guidance system, will result in or support a capability to meet the all-weather delivery requirements worldwide, with the required accuracy and range. The subsystem will have high resistance to jamming.
A-2	The task will result in a capability for long range guidance of stand-off guided munitions.
A-3	Alternate solutions will be available (D/L, DME) for area targeting.
A-4	Stand-off guided weapons will be primarily used against stationary targets or slow-moving ships.
A-5	The subsystem, when used with a subsystem to provide error corrections, will result in a capability to meet the all-weather delivery requirements with required accuracy and range.
A-6	The subsystem will result in a capability to meet the all-weather delivery requirements with required accuracy and range. The passive guidance subsystem is ineffective over open seas.
A-7	The subsystem will result in a limited all-weather capability with required accuracy. The passive guidance subsystem is ineffective in precipitative weather conditions.
A-8	The task will provide an interim capability for standoff guidance in an ECM environment. The subsystem is restricted to daytime, clear weather operations.

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APPENDIX G

EXAMPLE OF PRIORITIZATION OF PROGRAMS

The table shown in this Appendix is supplementary to the examples presented in Section VI of this document. It is representative of the prioritization of the appraisal programs. The table will include all programs that survived the appraisal. For convenience, the R-values for Need, Return-on-Investment, and Uniqueness are shown with the computed rank-values and the categories into which they fall. Separate program listings will be made for the exploratory and advanced development programs.

TABLE G-1. EXAMPLE PROGRAM PRIORITIZATION

PROGRAM	R_1	R_2	R_3	RANK	CATEGORY
Low-Cost Inertial Guidance System	3	3	3	18	A
Tactical Global Positioning System Guidance	3	2	3	16	A
Arm/Home-On-Jam Data Link for GBU-15	3	1	3	14	B
Radiometric Area Correlator	2	2	1	11	C
Millimeter Wave Contrast Guidance	2	2	1	11	C

APPENDIX H

EXPANDED AFATL RELEVANCE TREE AND APPRAISAL CODE

This Appendix is supplementary to the examples presented in Section VI of this document. It contains:

- The AFATL relevance tree with the Level 6 elements expanded
- The Appraisal Code Description.

Each figure complements the other in the development and understanding of the organizational techniques to be used in automating the appraisal process.

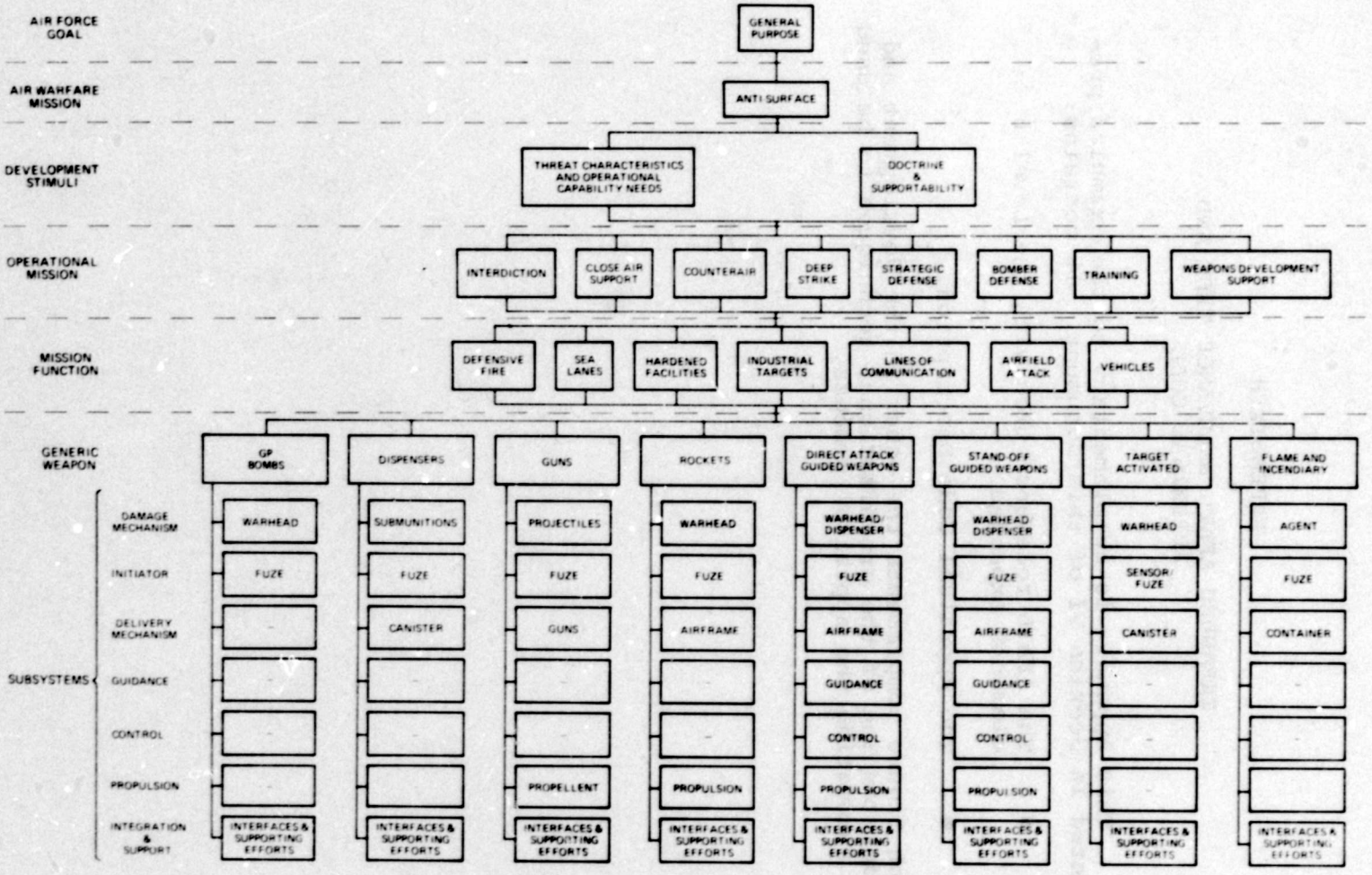
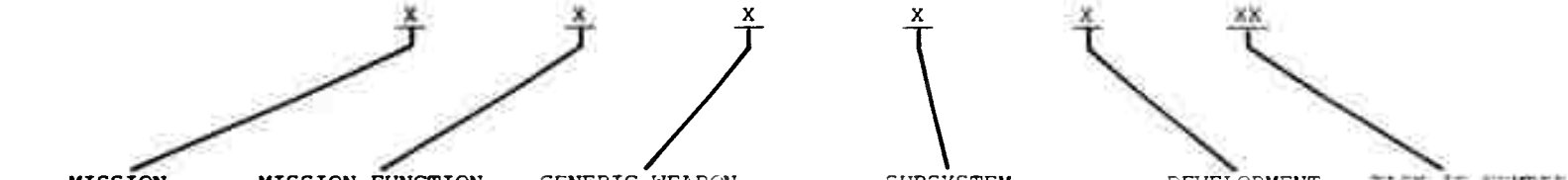


Figure H-1. Expanded AFATL Relevance Tree



MISSION	MISSION FUNCTION	GENERIC WEAPON	SUBSYSTEM	DEVELOPMENT	TASK ID NUMBER
1. Interdiction	1. Defensive Fire	1. GP Bombs	1. Damage Mechanism	X - Exploratory	(TBS)
2. Close Air Support	2. Sea Lanes	2. Dispensers	2. Initiator	A - Advanced	
3. Counter Air	3. Hardened Facilities	3. Guns	3. Delivery Mechanism		
4. Deep Strike	4. Industrial Targets	4. Rockets	4. Guidance		
5. Strategic Defense	5. Lines of Communication	5. Direct Attack Guided	5. Control		
6. Bomber Defense	6. Airfield Attack	6. Stand-Off Guided	6. Propulsion		
7. Training	7. Vehicles	7. Target Activated	7. Interface and Supporting Efforts		
8. Weapons Development Support		8. Flame and Incendiary			

EXAMPLE: **4464 X 01** An exploratory development task (i.e., millimeter wave technology) pertaining to the guidance of a stand-off guided weapon to defeat industrial targets during a Deep Strike Mission.

Figure H-2. Appraisal Code

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